ENVIRONMENTAL QUARTERLY

January • 1960

The Pioneer Space Age Publication of Environmental Simulation, Testing, Engineering and Equipment Manufacturing

INDEPENDENTLY PUBLISHED

Volume 6 • Number 1

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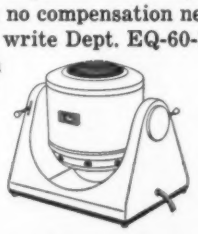
Ling's new wide-band Model 175 Shaker met the test—running full stroke for hours in a rain of metal chips! Ling's newly developed polyeurythene stabilizer assembly proved virtually indestructible—showing no wear after a test run equivalent to a year's normal operation. Moreover, this 1500 force-pound output shaker is fully enclosed; moving parts and coil are protected by end covers and a diaphragm which screen out foreign matter. Full webs extend to the coil for a rigid armature with a high first resonance of 3800 cps. Compensation is easy over bandwidths up to 4000 cps—with no compensation needed below the 2000 cps range. Call or write Dept. EQ-60-1 for details on Model 175, an optimum combination of the most useful performance characteristics.



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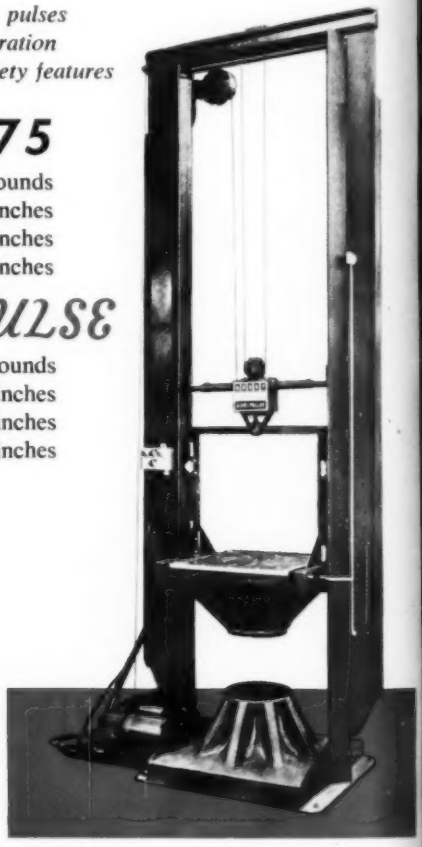

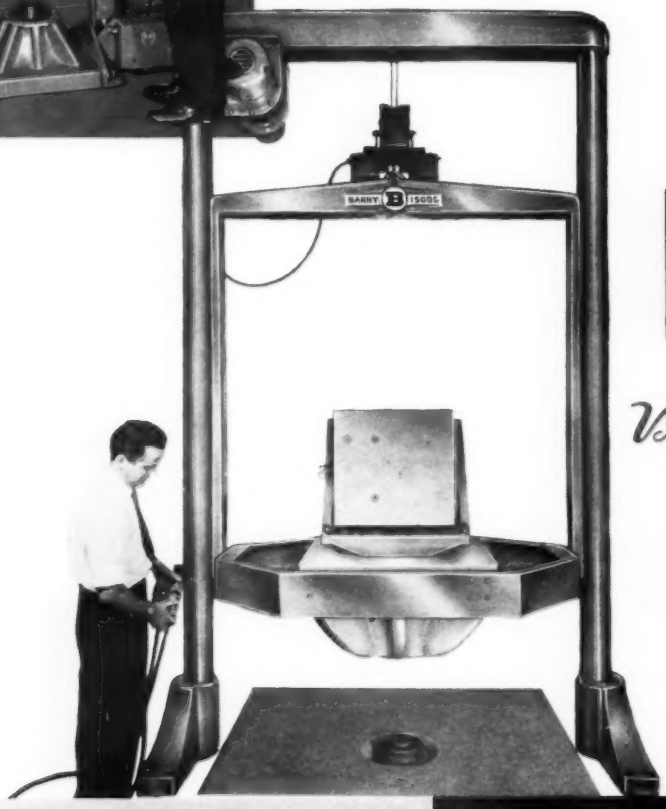

VARIPULSE Type 15000

Maximum load: .....400 pounds
Table capacity: 30 x 30 x 67 inches
Machine height: ....12 feet 6 inches
Floor space: ....72 inches x 94 inches

Leaders in Shock Simulation

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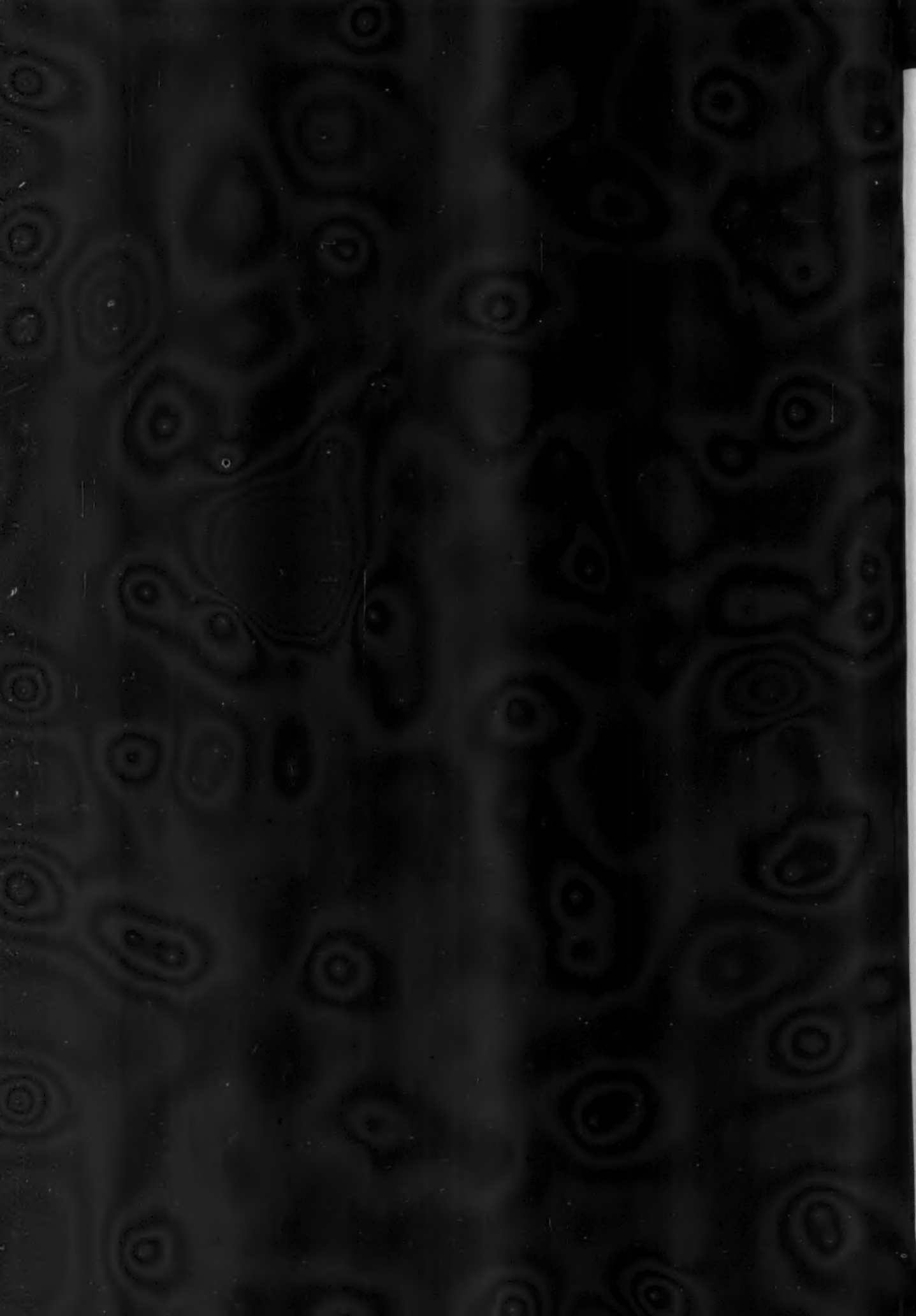

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Type 16750

For Production and Laboratory Shock Testing of Small Components

- automatic half-sine cycling
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- identical pulses
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Maximum load:
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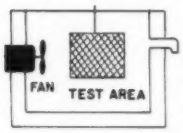
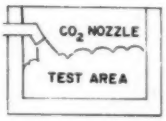


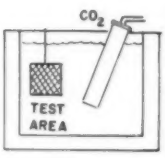
Simple, easy, inexpensive. A fan blowing over a wire basket full of crushed dry ice will reduce chamber temperatures from 0 to —70°F. A quick, low cost method for making occasional or isolated cold tests.

2 direct discharge of liquid CO_2



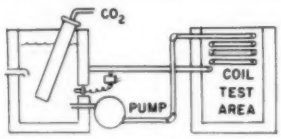
Easiest, most efficient method for consistent, cold testing in production operations. Bulk liquid carbon dioxide is discharged directly into the test chamber. You get controlled test conditions from 0 to —100°F. in 60 seconds or less. Best of all, one CO_2 storage tank can serve a battery of test chambers.

3 immersion tank method



For low cost production-line cold testing. Crushed dry ice or bulk liquid CO_2 is injected into an acetone, methanol or trichlorethylene base solution. Items to be tested are immersed in the slurry which has a temperature of minus 109°F. An ideal method of making cold "shock" tests.

4 indirect cooling method



Bulk liquid CO_2 is discharged directly into refrigerant line or surge tank containing acetone, methanol or trichlorethylene type solution. Refrigerant is then pumped thru test chamber to reduce temperature by means of coil-type heat exchanger. Major advantage—no CO_2 atmosphere in test chamber . . . an important factor where this condition is not desirable.

This exclusive feature can save you up to 15%
CARDOX® PATENTED RE-CYCLING SYSTEM keeps Liquid CO_2 COLDER . . . minimizes vapor loss

Low pressure liquid Carbon Dioxide storage tanks are located some distance from the point of use. Heat in the piping may vaporize a part of the liquid CO_2 so that vapor as well as liquid CO_2 arrives at the nozzle. This is undesirable for several reasons.

1. The vapor has reduced refrigerating effect and results in a loss of CO_2.
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3. Starting may be delayed as large amounts of vapor must be discharged before pipe cools sufficiently to eliminate creation of vapor.
4. Vapor discharge can interfere with temperature control accuracy.

The exclusive Cardox Re-Cycling System eliminates these disadvantages.

Float valve just prior to the nozzle separates vapor from the liquid CO_2. A vapor pump connected to a return line pumps the vapor back to the storage tanks.

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CARDOX systems can be engineered to provide temperature ranges from 0 to —150°

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CHEMETRON

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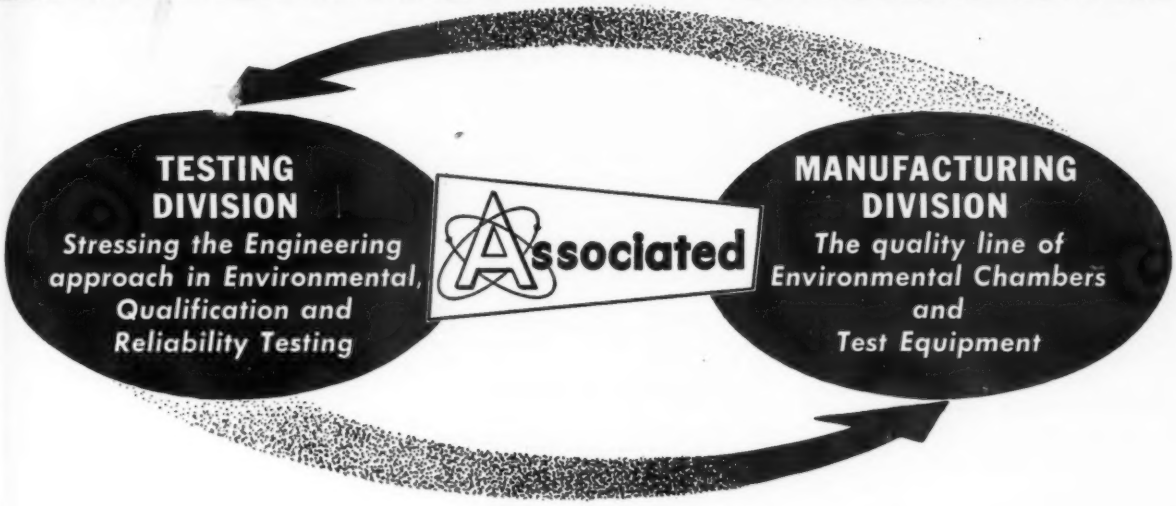
TESTING DIVISION
Stressing the Engineering approach in Environmental, Qualification and Reliability Testing
Associated
MANUFACTURING DIVISION
The quality line of Environmental Chambers and Test Equipment

The skill and know-how gained from the coordination of Associated's two divisions through "feedback" of information assures the proper utilization of test equipment within the Testing Division and the proper design of environmental test equipment within the Manufacturing Division.

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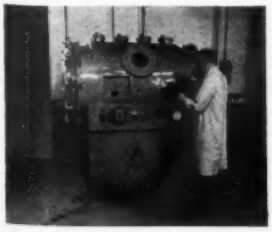
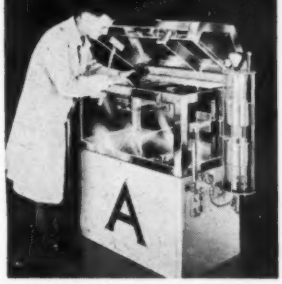
Sawtooth shock test being performed on a Shock Test Machine developed by Associated.



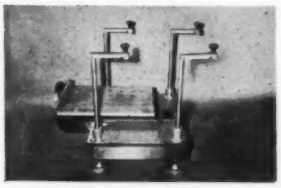
Explosion-proof testing in accordance with specifications MIL-E-005272B, MIL-E-5272C, MIL-E-5422D, etc.

Reliability testing being performed using automatic check out panels.

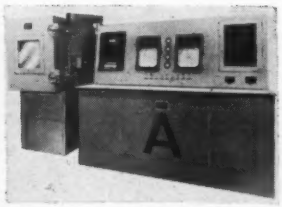
MANUFACTURING DIVISION



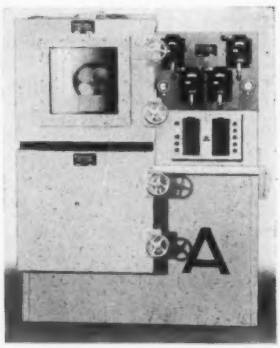
All Lucite Salt Spray Chamber built to perform tests in accordance with specifications MIL-E-5272A, QQ-M-151A, MIL-STD-202A, etc.



Auxiliary Vibration Table (Slippery Table) a complete line, adjustable in height, for use with any vibration machine.



Temperature-Altiude Test Chamber for environmental testing within the range of −300°F to +1200°F and from sea level up to 350,000 feet.



High temperature—low temperature chambers available in single or dual units for testing range of −300°F to +1200°F.

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TO ADVERTISERS and Editorial Contributors

The April-dated issue of ENVIRONMENTAL QUARTERLY will be published a month earlier than usual this year. Please observe the following schedules for this issue only:

Deadline for articles	**Jan. 18**
Deadline for new product, new literature, personnel, business and other announcements	**Jan. 25**
CLOSING DATE for display ads	**Feb. 1**
Display ad copy deadline	**Feb. 8**
Deadline for Want Ads	**Feb. 10**
Complete plates due at printer (if no proof is required)	**Feb. 22**

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Quarterly welcomes competent expressions of opinion, but statements in its pages do not necessarily reflect its views. Right is reserved to extract portions of letters and other material submitted for publication. Correspondents must be fully identified, but names will not be published if such a request is made.

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ENVIRONMENTAL QUARTERLY

The Pioneer Space Age Publication of Environmental Simulation, Testing, Engineering and Equipment Manufacturing

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To all in environments, a happy decade!

What does it hold, environmentally speaking? In the last issue Environmental Quarterly began a penetrating study of the "Path of the Environment." The series continues in this issue and there will be another entry or two in the next.

During the past year, EQ put the question of coming environmental needs to a great many persons. Their replies add up to a demand for higher, hotter, colder and emptier conditions than ever before.

At the same time it is predicted, a new battery of tests, including radiation and other cosmic forces, will become commonplace, and single-testing will give way to combined environments.

Writing in the "Newsletter" of the Prevention of Deterioration Center of the National Academy of Sciences, J. T. Townsend, special assistant to the director of defense research and engineering, made these interesting observations:

"We have not yet adequately recognized environment as a discipline, a subject capable of systematic treatment. Before the engineer can ask for data on environmental stresses, it is necessary that the parameters causing these stresses be firmly established and agreement reached on them. We need to know a great deal more about environments, and we need to have this information available in terms that the engineer can use.

"New mission requirements and demands for higher performance with their resultant complexity are causing design engineers in components work to think in terms of failure rates on the order of 0.001 per cent per 1000 hours. Our present figures are on the order of 0.2 to 10 per cent per 1000 hours."

In summing up the uncharted fields ahead, Robert H. Brown, vice president, Tenney Engineering, Inc., Union, N. J., said:

The increasing need for environmental testing facilities that will simulate conditions in space poses engineering problems for which there is no previous background of knowledge or engineering experience. Test equipment to simulate space environments at altitudes above 150-200 miles is needed."

Charles F. Conrad, of Conrad, Inc., Holland, Mich., feels that despite the military emphasis, commercial applications related to Federal road building and testing of materials will increase. A large potential also exists in the speed freezing of food items, he believes, and test chambers will have to simulate a million feet of altitude and have temperature ranges up to 1200° F.

Richard Seidman, chief engineer at Development Engineering Co., Inc., Norwalk, Conn., feels that "more severe testing with narrower tolerances will be the future trend;" and expresses the opinion that equipment will become simpler and easier to operate so as to concentrate technical time on the unit being tested.

Says Richard F. Hahn, of United States Testing Company, Hoboken, N. J.

"We strongly feel that refinements in measurement form and measurement techniques as well as maximum utilization of equipment on hand will be the byword in an increasingly competitive business.

R. A. Hawkins of AVCO's Research and

(Continued on Page 6)

ENVIRONMENTAL EQUIPMENT

Bemco, Inc. is an acknowledged leader in the development, design, manufacture and servicing of environmental equipment. The Bemco line of semi-standardized equipment provides economy of manufacture and flexibility of arrangement, control and configuration.

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Bemco's complete line provides any condition of altitude, vacuum, temperature, humidity, sand and dust, salt spray, explosion, sunshine and rain. Many types of chambers are available for immediate delivery from stock.

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Post Scripts

(*Continued from Page* 5)

Advanced Development division, Wilmington, Mass., sees a new viewpoint coming.

"Reliability is the biggest single obstacle to successful long range missiles and space vehicles," he says "Reliability will not be attained by flight testing; massive evaluation programs executed on the ground will be required. A change of pace that will de-emphasize the glittering concept in favor of the detailed engineering is sure to have a salutary effect on the environmental equipment industry."

A Circulation Note

We are grateful to LDS, of Tucson; DCC, of Falls Church; GWB, Whittier; WWW, Albuquerque; HES, Camden; GK, Baltimore; HDC, Sunnyvale; RJW, Livermore; SAC, Langley Field, and the many other readers who have taken the trouble to send us notes praising Quarterly.

Requests for subscriptions keep pouring in (see circulation policy statement on Page 4). In fact, we seem to be so well liked that occasionally a new-reader name crops up twice! If you have gotten Quarterly once, it isn't necessary to follow-up with another card, unless there is an error in the address.

If you are making a move, however, please let us know as soon as possible. If you can, clip the address part of the envelope in which your last issue arrived and send it along with your new address.

And don't forget to give your name! In recent weeks we have received an unsigned change of address notice from Camden, N. J., and an unsigned Reader Service Card from Newtonville, Mass. Were they yours?

Sunglasses, Men! !

Color is catching up with the environmental lab which has rocked along with gray, black and aluminum for a generation or more. The L.A.B. Corporation is painting all its testing machines vista green set off with touches of canary yellow. Farewell, black crackle; goodby, battleship gray!

Another New Feature

On Page 22 of this issue, Environmental Quarterly inaugurates still another new feature for its readers. The general heading: Environments in Use. The general idea: To report briefly on actual experiences—or call it case histories, if you like—in solving problems involving environments. We hope you find it helpful.

Letters to the Editor

EDITOR,
ENVIRONMENTAL QUARTERLY:

The article in your October, 1959, issue entitled "The Plus and Minus of CO_2," was read with much interest. Electronic Communications, Inc., has been using liquid CO_2 for about three years. Our manufacturing division has two 12,000 lb. tank installations, plus smaller portable tanks, and in engineering we have capacity for 16,000 lbs. for the environmental test laboratory.

When ECI relocated in St. Petersburg from New Jersey, a number of new test chambers were ordered with mechanical refrigeration, but we changed over to liquid CO_2 prior to delivery.

Two older chambers which we moved from New Jersey were originally equipped with mechanical refrigeration. Since relocating we have com-

(*Continued on Page* 19)

CINCINNATI SUB-ZERO CHAMBERS feature

RUGGED CONSTRUCTION

Cabinet heavily built to most exacting test requirements . . . for dehydrating gases, simulating hi-lo temperature conditions, accurate calibration of instruments . . . through

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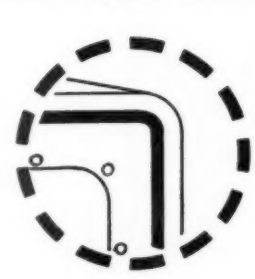

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Complete information on both the Model C181 and the Micro-Rate Accessory is available from your Genisco representative. If you prefer, write directly to the Director, Mechanical Div.,

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AROUND THE ENVIRONS...

ENVIRONMENTAL CHIT-CHAT: Maj. Gen. Alfred F. Kalberer, of the Air Force, holds the center of attention at the second-day luncheon of the second annual two-day symposium and product exhibition sponsored by the IES' New York Metropolitan chapter.

Exhibit corridor scene, right, is typical of informal gatherings that waxed and waned on the second floor of the Henry Hudson Hotel in New York City. Subject of the meeting: instrumentation.

I E S Prepares for 4th Annual Meeting

New York environmental engineers last month offered a two-day preview of the forthcoming national meeting of the Institute of Environmental Sciences. It was part of a surge of professional activity that marked IES growth from coast to coast.

Typical was the October 7 dinner meeting of the Middle Atlantic chapter at the Glascow Arms restaurant, Glascow, Md. Thirty-six persons attended the meeting, which was chaired by Martin Schletter, of Tenney Engineering, Inc., chairman of the chapter. John P. Antolak, director of carbon dioxide technical sales of Liquid Carbonic, discussed expendable refrigerants. A subsequent meeting of the chapter was devoted to high altitude simulation.

The IES' Southern Tier chapter met in Binghamton on Nov. 19 to hear Bernard Friedman, technical director of International Radiant Corp., discuss "Yardsticks for Environment." The material he used forms the basis of an article in the current "Environmental Quarterly." The chapter's next meeting was scheduled for this month.

On the West coast, the Los Angeles chapter, under Jerry Bakalish, of Firestone, chapter president, was busy preparing to be host to the 1960 national meeting of the IES. Scheduled for the Biltmore Hotel, Los Angeles, April 6-8, the theme of the meeting and accompanying trade show will be "Hyper Environments . . . Space Frontier."

The '60 session, although the fourth of its kind, will be the first to be held on the coast and the first under the aegis of the IES, formed at the '59 national meeting in Chicago through a merger of the Institute of Environmental Engineers and Society of Environmental Engineers (now the Los Angeles chapter).

Neal Granick (66 Waverly Ave., Dayton, Ohio) is technical program chairman, who should be contacted by those interested in presenting papers. Bruno J. Forsher (16556 Bircher St., Granada Hills, Calif.) is chairman of the exhibit committee.

Meeting Subjects Listed

The meeting will be divided into daily morning and afternoon programs, each consisting of three parallel sessions dealing with space systems and hardware, human factors and terrestrial support. Subject matter will cover thermal extremes, zero gravity, space vacuum, radiation, induced stresses, combined and sequential environments, planet and satellite environments, handling, transportation and storage environments, meteoric particles and dissociated gases and ionization.

Several hundred members and guests of the New York Metropolitan chapter attended technical meetings and viewed some 20 exhibits on the second floor of the Henry Hudson Hotel Dec. 10 and 11. The theme was "Instrumentation for the Environment."

For the occasion, the chapter published a pocket-size, 52-page program book and a voluminous "Proceedings" with a matching cover depicting a filamentary nebula.

Symposium Subjects Listed

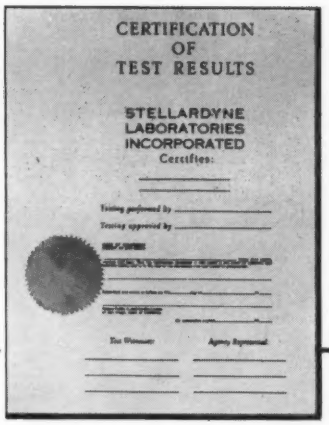
The "Proceedings," edited by Peter C. Anderson, of American Bosch Arma Corp., covered:

Digital techniques and automation, with papers by Philip L. Hillman and Herbert A. Seidman, General Precision Laboratory, and by Richard R. Hahn, United States Testing Co.

Instrumentation for radiation environments, with papers by Joseph Lorch, Empire Devices, Inc.; James Wiland and

(*Continued on Page* 10)

OUR NAME HERE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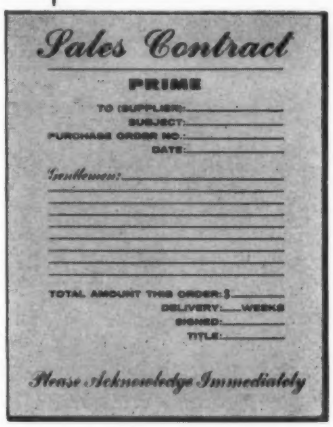
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Around The Environs

IES Sets Meeting

(*Continued from Page 8*)

David Askin, Frankford Arsenal, and Myron A. Schmutzer, United States Testing Co.

Data philosophies and applications, with a paper by Enoch Durbin, Princeton University.

Data analysis, with papers by William J. Reich, Jr., and Marvin Schnee, American Bosch Arma; Robert C. Moody, Technical Products Co., and Stanley Rogers, Convair.

Instrumentation for modern environmental facilities, with papers by Wayne Tustin, MB Electronics, and Frank H. Gardner, Tenney Engineering, Inc.

Instrumentation of shock and vibration environments, with papers by Dean B. Arlidge and Richard F. Morse, Consolidated Vacuum Corp.; Bruce L. Sutton, Gilmore Industries, Inc., and George R. Spalding and Joseph N. Baham, Sperry Gyroscope Co.

Chairmen of the respective sessions were Jesse Markowitz, E.R.A. Associates; John Cammarata, American Bosch Arma; Norman Meyers, The Martin Co.; Dr. Irwin Vigness, U. S. Naval Research Laboratory; Edward Jones, Bell Laboratories, and Dr. Robert K. Mains, Knolls Atomic Laboratory.

John Sexton, of American Bosch Arma, was chairman of the symposium. Lyle B. Webster, of Sperry, was program chairman, and Norman Ponge, of Space-Tronics, Inc., was exhibit chairman. Arma's William N. Protz was facilities chairman.

A number of new products were introduced at the New York meeting. For example, Endevco Corporation exhibited its Model 2702 Dyna-Monitor and released for sale its hermetic seal accelerometers, Models 2232-2235 for combined testing.

General Precision brought along a digital computer to test the poker playing skill of the visitors. It was reported on good authority that the machine did not win all the games.

Let's See . . . Turn Left At Sirius and Keep Right . .

Road maps in space are being prepared by GE's Missile and Space Vehicle Department for an Army and two Air Force research centers. The Army wants orbital parameters of earth satellites; the AF a generalized interplanetary trajectory study and three-dimensional trajectories of space vehicles to predict future positions immediately after firing.

Fort Monmouth at 500,000'

The Army has a new test chamber at Fort Monmouth that can duplicate environments at 500,000 feet.

The Count Is Down

Rockets as well as manned bombers were being shot down in Washington as planners of the 1960-61 military budget tried to hold the line on defense spending.

The Vega rocket, for which Convair had a $35-million contract, fell behind schedule and became an inviting target for budget gunners. Vega, one of an entire new family of space rockets, was designed to boost 5,000-pound satellites into earth orbit or put 1,000 pounds of instruments on the moon. The Centaur and the Atlas-Agena will take over their sister's missions.

B-52, B-70 Programs Hit

Sperry is losing a large contract for countermeasures equipment for the B-52 jet bomber, the Wall Street Journal reported, and a drastic slowdown has befallen the supersonic B-70 bomber. Only two test models of the B-70 will be built under present orders, and the dream of a flect of the 2,000 mph six-engine jobs is fading in the flame and smoke of the rising missiles. A half billion dollars and four years of development have gone into the B-70, but it may pay off as a supersonic jet transport.

Defense sales in '60 may drop, General Electric said, predicting that U.S. R & D funds will be tighter.

More Money for Mercury

But much more money is going into Project Mercury, the plan to put a man into space. Officials conceded, however, that this is due not to any sudden loosen-

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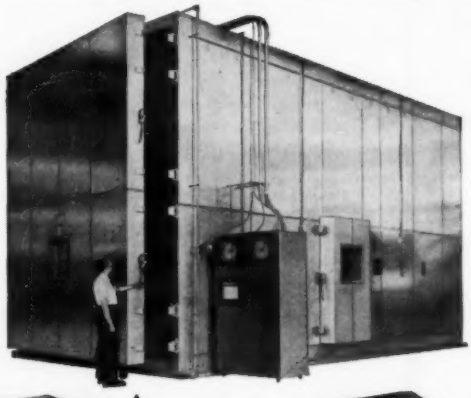

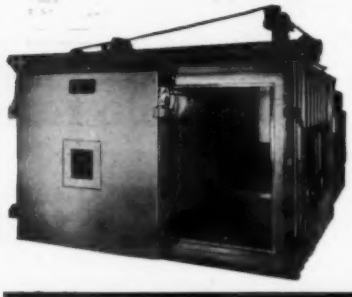

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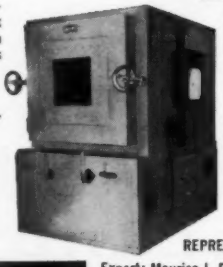

▲ Prefabricated Temperature and Humidity walk-in test facility with test space 12' x 25' x 15' high.

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ing of the pursestrings but a more realistic appraisal of what the job is going to cost. The Mercury price tag is now $350-million, about $150 million more than originally figured.

Chance Vought sounded a note of optimism for a nuclear powered ramjet engine. A missile with such a powerplant would have practically unlimited range, Chance Vought experts believe.

The Defense Department scrounged $100-million from other projects to keep the Mace project going when Congress refused to vote new money for the jet-powered 1,200-mile range missile, an advanced version of the Matador, built by Martin.

'Katie' Knows

Who knows what—and where is he? The Air Force thinks it can tell with a super-duper machine. Known as CATE (Katie), the system centers around a punched card file listing the research ability and intellectual qualifications of 15,000 top U.S. scientists.

Previously, the Air Force says, it took months to pick the best consultants. Now CATE can find the right man in a day or less.

Reliability Supplements Resumed by Navy

The Navy has resumed publication of quarterly supplements, suspended a year ago, to its electronics reliability handbook. The handbook, which is intended to help designers to achieve greater simplicity, economy and reliability in Navy electronics, and the supplements are sold by the Office of Technical Services, Department of Commerce, at $3 and at 75 cents, respectively.

Schomburg to Huntsville

Maj. Gen. August Schomburg succeeds Maj. Gen. John M. Mendaris as commander of the Army Ordnance Missile Command, Huntsville, Ala., at ceremonies slated for the end of this month. Schomburg, 51, has a long background in R & D work and was assistant chief of ordnance for research and development before his most recent job, deputy chief of ordnance.

MISCELLANY GE has been awarded a $29 million Air Force contract for Thor nose cones. Incentive payments are provided for rejects and servicing below an expected norm, and for savings on production costs.

Fairchild Engine and Airplane Corp.'s subcontract work on the B-52 has been extended into early 1961 with an $8½-million contract from Boeing to produce major sub-assemblies for the B-52H Stratofortress.

Aerojet-General Corp. is working on a $2-million Army contract for nearly 700 rocket motors for the Hawk missile.

DR. EDWARD HEROLD DR. LOUIS MALTER DR. ROBERT JEPSEN

TOP LEADERSHIP IN HIGH VACUUM

Varian recently announced the creation of a separate Vacuum Products Division as a direct result of the universal acceptance received by Varian's VacIon® Pumps since their introduction two years ago.

The Varian men pictured above provide the managerial and research leadership which assures continued progress in high vacuum and other electronic fields.

The VacIon Pump, a unique electronic device for achieving clean, ultra-high vacuum, was originally developed at Varian Associates to improve the quality of the company's microwave tubes. The exceptional simplicity and reliability of VacIon Pumps have since led to widespread acceptance for research and production in all applications requiring high vacuum. For an insight into the applications and importance of this new equipment, please write for a comprehensive brochure and technical data. Address Vacuum Products Division.

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Path of the Environment:

YARDSTICK FOR ENVIRONMENTS

Far from an exact science, environmental engineering, in this writer's view, resembles an art similar to medicine, psychology, or economics. The goal is seen as a product reliability rating culled from consistent and repeatable results of tests within a chamber, correlation of results of the same test in similar chambers and correlation of chamber test results with field experience.

by Bernard Friedman
Technical Director
International Radiant Corp.

MIL-E-5272A AND PARALLEL military specifications relate primarily to temperature, humidity and altitude environmental performance levels associated with "logistics." The term is meant to describe qualifying environmental tests to demonstrate equipment reliability and performance potential after long-term or short-term storage in the arctic, temperate, or tropic areas, and after transportation by conventional aircraft, ship, or truck.

Tests relating to the specific environmental factors that prejudice or influence the performance of critical components subjected to conditions beyond those of the standard logistics specs are detailed in component specifications, or are made a part of specific procurement specifications. Both standard and special specs may approach test requirements as an attempt to reproduce an environment exactly as it is known, or to create a situation having no direct relationship to the actual environment, except that when product failures are induced the nature of the defect is typical of those found in actual field experience. The latter philosophy assumes that an item which does not fail under test will have a satisfactory service life.

A dual approach is found in MIL-5272. To quote in part: "This specification establishes generally applicable procedures for testing aeronautical and associated equipment under simulated and accelerated climatic and environmental conditions. Procedures prescribed herein are to be utilized in subjecting equipment to simulated and accelerated environmental conditions in order to insure satisfactory operation and to reduce deterioration when the equipment is operated or stored in any global locality ..."

'True' Simulation Sought

MIL-STD-210 provides for true simulation of environment, stating: "This standard indicates the probable extreme climatic conditions of the natural environment to which military equipment may be exposed, and is intended to establish uniform limits not to be exceeded in normal design requirements ....."

MIL-STD-202 purports to "....specify suitable conditions obtainable in the laboratory which give test results equivalent to the actual service conditions existing in the field, and to obtain reproducibility of the results of tests. The tests described herein are not to be interpreted as an exact and conclusive representation of actual service operation in any one geographic location, since it is known that the only true test for operation in a specific location is an actual service test at that point ....."

Method 106A, a revision to MIL-STD-202 describes the philosophy more clearly and in greater detail:

"PURPOSE. The moisture-resistance test is performed for the purpose of evaluating, in an accelerated manner, the resistance of component parts and constituent materials to the deteriorative effects of the high-humidity and heat conditions typical of tropical environments ....."

Results Are Often Inconsistent

How valid are test programs? General rules of procedure are carefully outlined in the testing specifications, and they are followed. Yet test results are often inconsistent. Are these erratic results due to inadequate test equipment, deficient testing methods, or erratic product quality?

This is the big question confronting the environmental practitioner. When we can say that test equipment and test methods do not contribute to false or erratic test results, environmental practitioners may achieve engineering status.

Humidity testing is an area in which weaknesses in test equipment or methods of carrying out tests may frustrate the intent of the military specifications. Equipment is

Friedman

The reply to a request for biographical data from Bernard Friedman is as reserved as he himself is, except perhaps when he's discussing environments. Here it is: "Received BS in mechanical engineering from Lehigh University. Participated in development and manufacture of environmental equipment for over 11 years. Formerly vice president, Institute of Environmental Engineers. Presently technical director, International Radiant Corp., New York, N. Y." The material in this "Path of the Environment" article formed the basis of an address the author delivered at the Nov. 17, 1959, meeting of the Southern Tier chapter, Institute of Environmental Sciences, in Binghamton, N. Y.

used with inadequate accuracy and/or resolution of the measuring and controlling instruments. Minimum standards in humidity simulation for instrument accuracy and resolution and for control system response should be at least 1° F.

Calibration Practices Inadequate

Where acceptable instrumentation may be employed, calibration practices are often inadequate to keep the instruments in proper operating order. Probably because accuracy of the indicated environment is vital in relative humidity testing, ASESA has indicated test equipment installations be qualified only if they regularly use calibration standards certified by the Bureau of Standards.

Accurate control equipment, accurately calibrated, can give false readings when used with dirty or improperly applied wicks for developing wet bulb depressions. There should be established for each chamber a correlation of the indicated and recorded environments with the actual environments which are present.

Inadequate insulation of the chamber can contribute to temperature gradients in the test space and cause ceiling condensate to drip on equipment.

Air circulation is also an important factor. MIL Standard 202 requires five volume changes a minute, while MIL 5272B specifies that the air circulation shall be limited to no more than 150 feet per minute around the test item. Although they appear contradictory, both of these specifications are important and should be met by careful equipment design. The five volume changes assure good temperature uniformity. It is obvious that temperature variation in the test space also is accompanied by relative humidity. The Armed Services have found that air velocity is a factor in attaining correlation or repeatable testing results.

Other areas where design weakness can contribute to false or misleading test results are in humidification and heating equipment. If heat is introduced in such a way that it radiates on surfaces of the item under test, condensation will not form on the surfaces, by virtue of their raised temperature, and potential failures will not be found. Humidification by spray water has the disadvantage of introducing contaminants, unless the spray water is distilled and/or demineralized. This is usually impractical, and so there may be product failures where none should occur.

Combined Temperature-Altitude Testing

Testing under conditions of temperature and altitude, usually does not require as much emphasis on control accuracy. Unlike humidity testing, a small variation in the accuracy will have little influence on the deleterious effect of the environment. The major problem in this phase of testing is correlating the actual environment with the indicated environment at elevated altitudes. For this, the air handling unit and air circuit arrangement should be predicted upon qualitative as well as quantitative design considerations. From a quantitative point of view, the air mover should be of maximum practical size to attain minimum adequate air-handling ability for the higher altitudes.

A 5,000 cfm air mover operating at +350° F. and at 70,000 feet will move approximately 10.3 pounds of air/minute. Each pound of air has the thermal capacity to absorb approximately ¼ BTU per degree of temperature rise. At 100,000 feet, the air mover, operating +350° F., may have a delivered volume of 5,000 cfm but will move less than 2.5 pounds of air per minute. Thus air mass quantities and inherent thermal capacity are significantly small in view of the large volumes handled at elevated altitudes.

A typical design problem requires accommodating a dissipated load of 5 KW, which is approximately 17,000 BTU/hr. load from other sources such as heat transmission into the chamber. Assuming that all of the air is directed

(Continued on Page 31)

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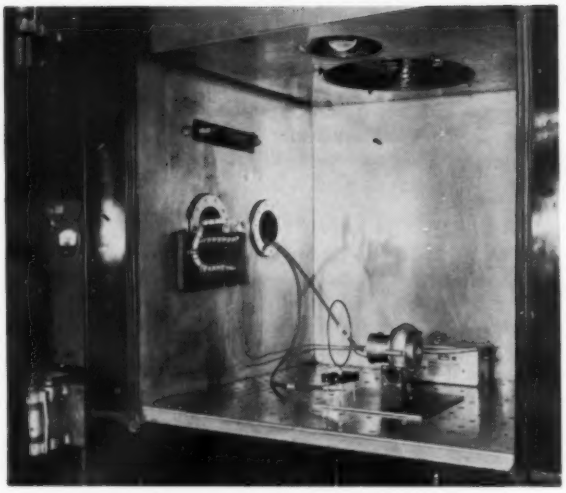

UNSHIELDED LOOP for measurement above 25 mc, installed in 27-cubic-foot Conrad, Inc., environmental test chamber at Radioplane.

R. F. Interference In Extreme Environments

by R. E. Shewmaker
Branch Engineer
Radioplane, a Division of Northrop Corporation

A TEST SPECIMEN of known broad-band radio frequency noise characteristics was subjected to simulated, combined environments of: (1) elevated temperature and humidity, (2) low temperature and altitude, and (3) elevated temperature and altitude. While the three conditions represent combined environments encountered in the pre-flight or flight of the XQ-4 supersonic target drone system, they are not uncommon in many other manned and unmanned aircraft.

Measurements were made through the frequency spectrum of 150 kc to 1000 mc using a 27-cubic foot Conrad climatic chamber. Standard radio noise and field intensity meters were used as detectors utilizing loop pick-up devices. Due to the confined area of the climatic chamber and its effect on the radiated fields, no attempt was made for amplitude accuracy, but attempt was made for consistency of measurement technique and comparative values.

The test specimen was a 28 vdc, .10 hp blower fan, rated at 35 cfm at 14,000 rpm and normally employed in inflating impact bags for the recovery systems of many of Radioplane's products, including the XQ-4. Certain elements of the test specimen's RF suppressors were disabled to maintain a sufficient noise level over the frequency spectrum.

Normal Mounting Copied

Installation in the test chamber was made in such a manner as to simulate as closely as possible normal mounting characteristics and to conform to Specification MIL-I-6181C, "Interference Control Requirements, Aeronautical Equipment." The line stabilization network installed in series with the power input leads of the test specimen was only for the purpose of conforming to the requirements of MIL-I-6181C as much as possible and to allow for conducted measurements, when and if desired. Because amplitude variations rather than accuracy were the basis of the measurements, the line stabilization network was considered as a constant. It remained in the circuit and was exposed to the environments during all tests.

Measurement of radiated fields throughout the frequency spectrum of .150 to 25 megacycles was accomplished by using an 8¼ inch loop antenna provided with the Stoddard NM20B radio interference and field intensity meter. For these tests above 25 megacycles a single-turn unshielded loop of the same physical dimensions was fabricated. Because of the difference in the electrical characteristics of the two loops, amplitude comparisons can only be made within those frequency bands using the same pick-up device.

A preliminary survey of the frequency spectrum indicated that the fabricated loop antenna was capable of detecting satisfactory levels of interference over the frequency range under study. At this same time, a point adjacent to the test specimen, which gave maximum indications, was selected for the permanent reference location of the loop antenna.

Extraneous Noise Negligible

Before the planned environments were simulated, a set of reference measurements was made with the test specimen operating in a normal manner and the internal area of the test chamber at ambient conditions of 77° F. and barometric pressure of 29.9 inches Hg abs (776 feet.) Measurement frequencies were at points representing maximum detected interference, determined by scanning, but at not less than 3 points per band from 150 kc to 125 mc, not less than every 25 mc from 150 mc to 400 mc, and not less than every 75 mc from 400 to 1,000 mc.

During these tests, close observations were made of the extraneous noise levels in the laboratory area. They were so low as to be considered negligible. Substantiating this was a second series of ambient measurements made at the conclusion of all the tests that indicated variations of the original measurements of no greater than ±10 per cent.

Shewmaker

R. E. Shewmaker came to Radioplane four years ago with a solid background in radio interference. He was a founder of California Electronic Services Co., specialists in the field, and before that he was at the Navy's Pt. Mugu missile test center. Before that he devoted four years to RF interference at the Naval Electronics Laboratory, San Diego. At Radioplane, where R. H. Pena and J. E. Woods helped him conduct the tests he reports on, he directs the electro-environmental lab of the Special Laboratories branch. This report is based on material also presented to the Army Signal Research Laboratory's fifth conference on Radio Interference Reduction and Electronic Compatibility last October.

Measurement of radio interference has, in most cases, been conducted in laboratories where climatic environments have been controlled for the comfort of those working in the area—or under "ambient conditions." Seldom, says the author, do these represent the operational environments of the particular system in question. Here is an account of the effects of extreme climatic environments on the propagation of radio frequency interference generated by a component commonly encountered in a complex supersonic target drone system.

Based on this information, these values were considered to be the "ambient reference."

The model specifications of the XQ-4 series supersonic target drone system defines the maximum temperature-humidity environments of the operational system to be equivalent to Procedure I of Military Specification MIL-E-5272, "Environmental Testing, Aeronautical and Associated Equipment." This procedure establishes a maximum temperature of 160° F. at a relative humidity of 95 per cent for a period of ten 24-hour cycles. Because the tests were to determine the effect of the environment on the propagation of spurious RF, rather than the deteriorating effects on the test specimen, the cycle requirement of the specification was deleted.

The internal temperature of the chamber was increased to +160° F., the relative humidity was controlled at 95 per cent and the test specimen was allowed to stabilize at this condition for one hour. Then the specimen was put into operation and a series of radiated noise measurements were made throughout the frequency spectrum.

In addition to scanning the frequency range for peak variations from the ambient reference, as a result of the environment, measurements were repeated at those frequency points originally established during the ambient reference tests.

The results of these tests are presented in the composite data chart as amplitude in decibels above one microvolt versus frequency and are shown in comparison with the ambient reference. The curve indicates that the characteristics of this broad band interference, as related to resonance and maximum noise levels versus frequency, have shown a negligible change as a result of the exposure to the environment. What appears to be a resonant condition at 25 megacycles is a result of the band width and sensitivity characteristics of the two detectors employed at this point. No correction factors were applied to the data collected and it was plotted as indicated amplitude. The amplitude difference remains relatively constant from 150 kc to approximately 3 mc. However, at 9.5 mc the amplitude difference increases to 14 db and continues to increase to 18 db at 15 mc, 26 db at 300 mc, and 42 db at 900 mc.

Low Temperature and Altitude

For the low temperature and altitude tests the test specimen was again located in the climatic chamber in a manner similar to its normal mounting. The test frequencies were the same as those selected during the ambient reference.

Pressures of 13.76 inches/mercury abs (20,000 feet) and 5.55 inches/mercury abs (40,000 feet) were selected as a nominal pressure range for the type of airborne systems involved. The equivalent temperatures for these pressure settings were based on the National Aeronautical and Space Agency's "Standard Atmospheric Predictions" of −12° F. at 13.76 inches/mercury abs and −67° F. at 5.55 inches/mercury abs.

Two complete series of measurements were then made.

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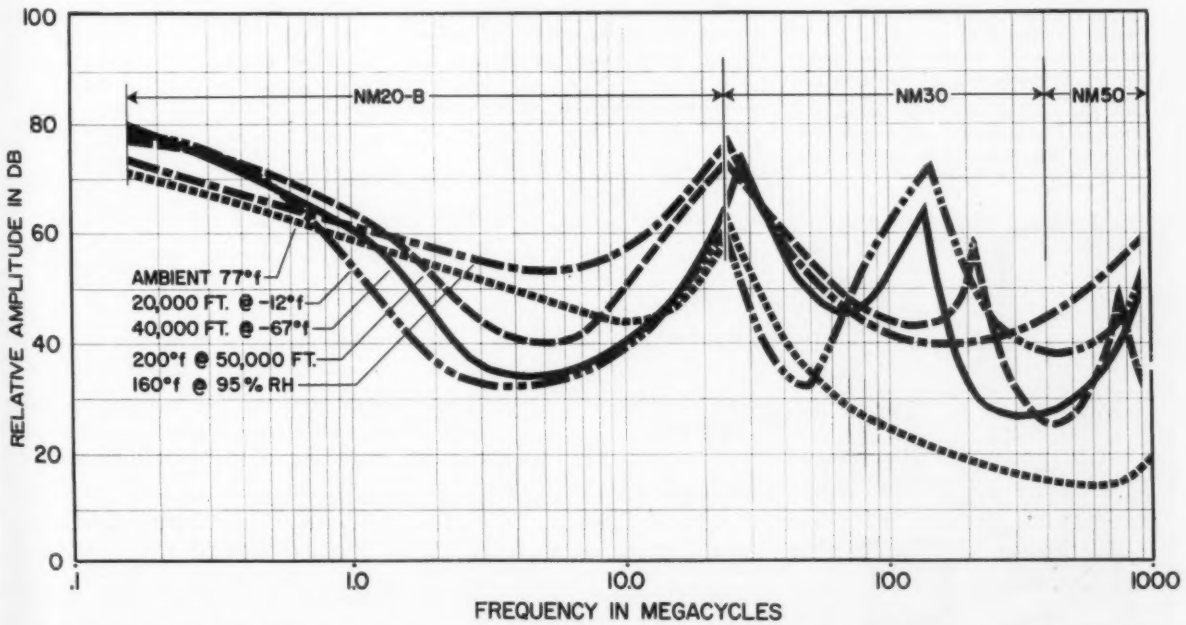


DATA COMPOSITE showing results of low tempe ature/altitude, elevated temperature/altitude and e'evated temperature/humidity tests.

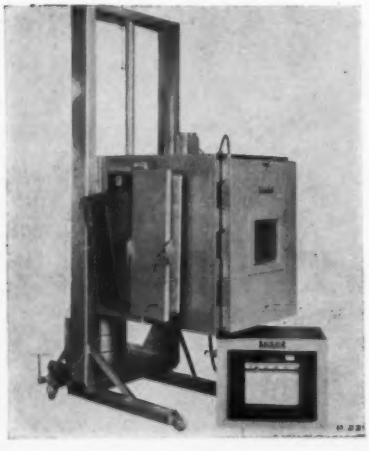
How Much for Cold?

by **Dale J. Missimer**
Vice President
Missimers Incorporated

The tabulation "Expendable vs. Mechanical—A Comparison," which accompanied the discussion of "The Plus and Minus of CO_2" in the last issue of Environmental Quarterly was so well received that the man who prepared it was asked for a companion, quantitative analysis. The two should be used together in selecting a cooling method.

LIQUID CARBON DIOXIDE AND DRY ICE are usually priced by the ton, at a rate determined by annual usage. Liquid nitrogen is sold by the cubic foot or by the liter, based on monthly consumption. Mechanical refrigeration costs, on the other hand, are represented mostly by a capital investment.

GETTING COLD: 12-cu. ft. mechanically cooled chamber (above) has —100° to +350° F. temperature range, J. I. C. wiring, time-temp program control to ±1° F. Below is a 7-cu. ft. temperature chamber for tensile, compression and flexural tests of critical missile structural components using liquid CO_2, dry ice, or liquid N_2, all controlled to ±1° to 2° F.



Thus, while there are many ways to compare one **method** of cooling with another, a matching of invoices would not be satisfactory. A cost comparison is feasible, however, by means of an annual usage factor.

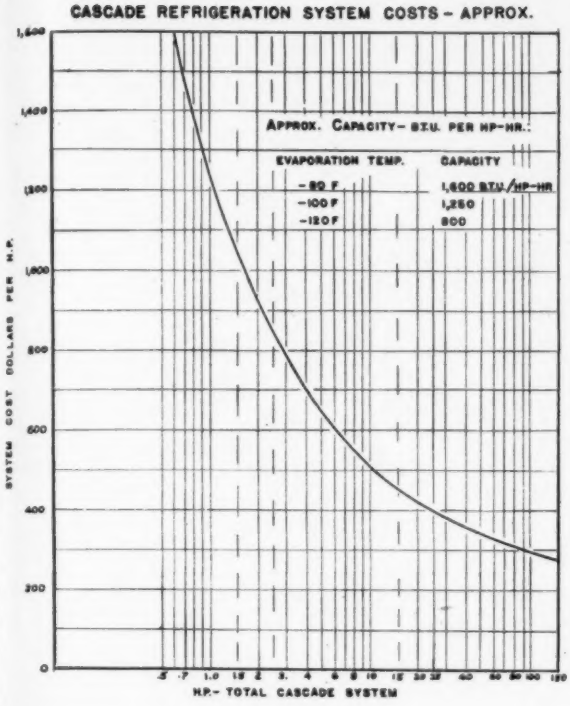
For mechanical refrigeration costs, Graph No. 1 gives the cost in dollars per horsepower for a cascade system vs. total system horsepower. For the single stage mechanical refrigeration system used to produce the refrigerant temperature of 0° F. for Graph No. 2, a cost factor of 80 per cent of that for a cascade system was used. For single stage system capacity, an average rating of 7,000 Btu per hr. was used.

In order to simplify the calculations, no handling costs were included for the expendable refrigerants, and no maintenance, power, and/or water costs are used in the mechanical refrigeration system pricing. To give an idea of the size of mechanical refrigeration systems required to provide the yearly cooling, the total system horsepower is shown at each end. For instance, a system having two 2 hp. compressors (4 hp total) will produce 2,000,000 Btu per year at a refrigerant temperature of —110° F. (approx. —100° F. air in a test chamber).

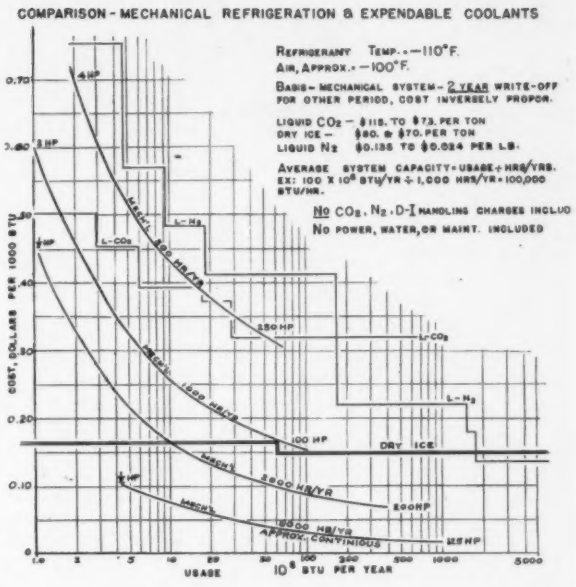
The graph of cooling at +10° F. air shows how few operating hours are required of a mechanical refrigeration system for costs lower than for expendable coolants, although the expendable refrigerants at this temperature have a lower cost per 1,000 Btu of cooling. This is due to the superheating of the vapors before being discharged from the chamber. Liquid N_2 gives 20 per cent more cooling at 0° F. than at —110° F.; liquid CO_2 cooling capacity rises by 17½ per cent, and dry-ice by 8 per cent.

Here is an idea of what amount of cooling is required for typical chambers (mechanically cooled):

	I.	II.
Size (inside)	10' x 25' x 8' high	3' x 3' x 3'
Insulation	8" Fiberglas	6" Fiberglas
Temperature	—100° F. air	—100° F. air
Operation	continuous	40 hr/wk, 50 wk/yr (2,000 hours)
Total Cooling (approx.)	13,000 Btu/hr for transmission and fan heat	5,300 Btu/hr for transmission, fan heat and live load
Live Load	none	1 Kw at —100° F. during operation
Pull Down		Neglected
Annual Cooling	114×10^6 Btu/yr	10.6×10^6 Btu/yr
Comparative Cost	About 1/5 dry ice	About same as dry ice


CASCADE REFRIGERATION SYSTEM COSTS – APPROX.
APPROX. CAPACITY – BTU. PER HP-HR.:
EVAPORATION TEMP. CAPACITY
– 80 F 1,600 BTU/HP-HR
–100 F 1,250
–120 F 800
SYSTEM COST DOLLARS PER H.P.
HP – TOTAL CASCADE SYSTEM

Graph No. 1

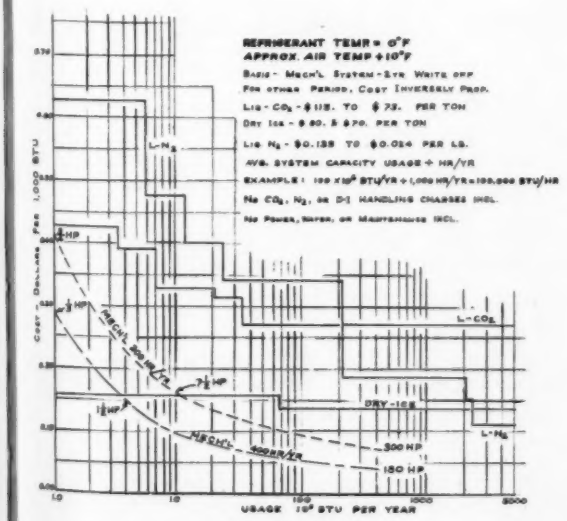

COMPARISON - MECHANICAL REFRIGERATION & EXPENDABLE COOLANTS
REFRIGERANT TEMP. = –110°F.
AIR, APPROX. = –100°F.
BASIS – MECHANICAL SYSTEM – 2 YEAR WRITE-OFF FOR OTHER PERIOD, COST INVERSELY PROPOR.
LIQUID CO2 – $115. TO $73. PER TON
DRY ICE – $80. & $70. PER TON
LIQUID N2 $0.135 TO $0.024 PER LB.
AVERAGE SYSTEM CAPACITY = USAGE ÷ HRS/YRS.
EX: 100 X 10⁶ BTU/YR ÷ 1,000 HRS/YR = 100,000 BTU/HR.
No CO2, N2, D-I HANDLING CHARGES INCLUD
No POWER, WATER, OR MAINT. INCLUDED
COST, DOLLARS PER 1000 BTU
USAGE 10⁶ BTU PER YEAR
DRY ICE

Graph No. 3

A number of factors cannot be compared directly. For example, if a test laboratory must pay capital costs, but its customers pay for operation expenses, then an expendable refrigerant may offer advantages which cause expendable coolants to be used even though low total costs would indicate mechanical refrigeration to be more logical.

The data in the graphs were prepared initially for a rocket engine manufacturer who required a long term soak at —100° F. air temperature. In this particular case, there was a large product cooling load present at infrequent times. For this application, a combination of a mechanical refrigeration system to hold the chamber at —100° F. continuously, and an indirect liquid CO_2 system, complete with cooling coils, sublimation tank and pump, to handle the large product load proved to be the most economical approach.

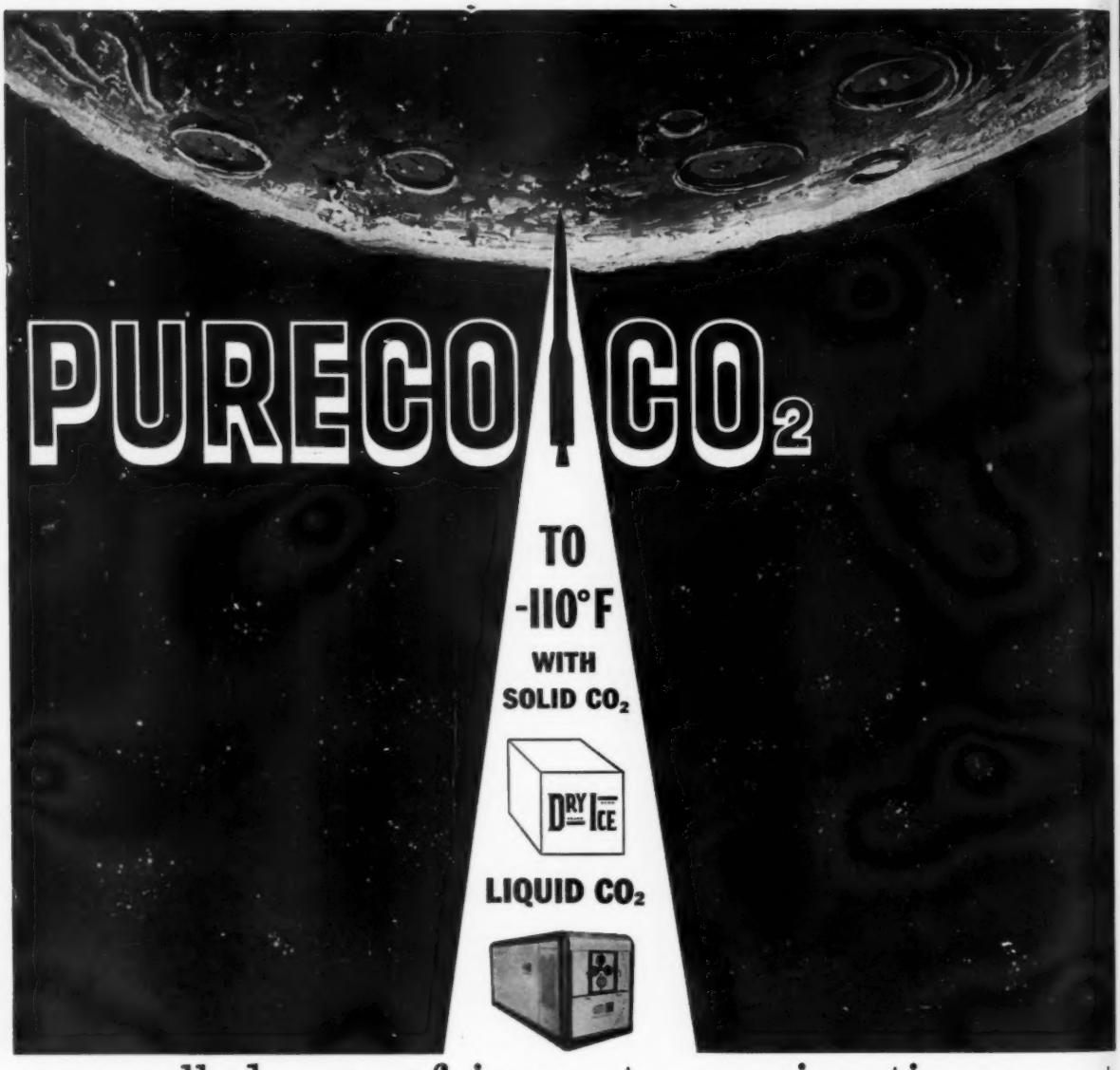
These graphs are more useful in determining orders of magnitude, rather than for arriving at exact costs. The cascade refrigeration system costs are somewhat of an average, and there may be differences as a function of the application or type of chamber.


REFRIGERANT TEMP = 0°F
APPROX. AIR TEMP = 10°F
BASIS – MECH'L SYSTEM – 5 YR WRITE OFF
FOR OTHER PERIOD, COST INVERSELY PROP.
LIQ – CO2 – $115. TO $73. PER TON
DRY ICE – $80. & $70. PER TON
LIQ N2 – $0.135 TO $0.024 PER LB.
AVG. SYSTEM CAPACITY USAGE ÷ HR/YR
EXAMPLE: 100 X 10⁶ BTU/YR ÷ 1,000 HR/YR = 100,000 BTU/HR
No CO2, N2, OR D-I HANDLING CHARGES INCL.
No POWER, WATER, OR MAINTENANCE INCL.
COST, DOLLARS PER 1,000 BTU
USAGE 10⁶ BTU PER YEAR
DRY-ICE

Graph No. 2

Missimer

Dale J. Missimer's presidency of the Los Angeles chapter of the American Society of Heating, Refrigeration and Air-Conditioning Engineers attests to his personal popularity and technical skill. He is chairman of the society's committee on ultra-low temperature systems and test chambers, and he is editor of the 1959 ASRE Data Book's chapter on refrigeration applications. A graduate of Rice Institute, Houston (B.S. in E.E. with distinction), he is a member of Tau Beta Pi and associate member of Sigma Xi.



unexcelled as a refrigerant, as an inerting agent

Pureco CO_2 in liquid or solid form is a convenient, low cost, maintenance-free refrigerant of unlimited capacity, which can be accurately controlled for use in low temperature testing and field conditioning.

Also, Pureco Carbon Dioxide is finding increased use in providing an inert atmosphere in test chambers and cells following or preceding the testing, handling or storage of explosive or combustible materials.

Pureco's Technical Sales Service is qualified to assist you in adapting CO_2 to any particular refrigeration or inerting application. Call your Pure Carbonic representative. There are more than 100 Pureco locations from coast to coast.

PURECO CO_2

Pure Carbonic Company

A DIVISION OF AIR REDUCTION CO., INC.

150 EAST 42ND STREET, NEW YORK 17, NEW YORK

AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT • Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** – Industrial gases, welding and cutting equipment • **AIRCO CHEMICAL** – vinyl acetate monomer, vinyl stearate, methyl butynol, methyl pentynol, and other acetylenic chemicals • **PURECO**–carbon dioxide–gaseous, welding grade CO_2, liquid, solid ("DRY-ICE") • **OHIO**–medical gases and hospital equipment • **NATIONAL CARBIDE**–pipeline acetylene and calcium carbide • **COLTON**–polyvinyl acetate, alcohols, and other synthetic resins.

Letters to the Editor

(Continued from Page 6)

pletely converted one of these and we are now converting the remaining one to CO_2.

One reason ECI prefers liquid CO_2 is the time involved to lower the chamber temperature. The chamber which is being converted took 7½ hours to go from room ambient to −65°C. With liquid CO_2 it does this in less than 20 minutes.

Reason No. 2 involves reduced operating and maintenance costs. The amount of electricity consumed is minor by comparison to the amount consumed in mechanical refrigeration.

Water cost is another factor. With liquid CO_2 our water consumption is reduced by several hundred thousand gallons per year. Also since no heat exchangers, etc., are involved, there is no maintenance and repair cost due to corrosion.

There is one other future advantage in that ECI's installation needs only minor conversion for temperatures lower than the low limit of liquid CO_2. The installation has been planned for changing over to liquid nitrogen if and when the need arises.

We have also found it very convenient to construct temporary chambers of various sizes for one-shot programs and for combined environments, particularly vibration at low temperatures.

Our installation at the present time covers both direct injection and secondary cooling, and in some cases a combination of both. We are also installing a complete cooling air set-up. Secondary cooling with liquid CO_2 will be used, permitting us to control cooling air flow and cooling air temperature under ambient temperatures of −90°F. to +300°F. and at altitudes of over 100,000 feet.

G. W. CARR
Manager, Reliability Engineering
Electronic Communications, Inc.
St. Petersburg, Fla.

Nov. 11, 1959

(Environmental Quarterly welcomes comments from its readers and hopes others will follow Reader Carr's example of describing pertinent experiences. By the same token, published letters themselves are subject to comment, praise or rebuttal by readers. For example, would the "plus and minus" of ECI's choice of refrigeration be universally applicable, or are there special circumstances in the St. Petersburg area, such as availability of water and cost of power, which might not be as significant elsewhere? Correspondents are urged to keep their letters short, and are reminded that what they write is subject to being abstracted for publication. Letters must be signed, but signatures will be withheld upon request.—The Editors)

NEW ENDEVCO
VIBRATION
SYSTEMS
Featuring: Transistorized charge amplifier and hermetically sealed accelerometer. You can use up to 300 feet of cable between amplifier and accelerometer —with no signal loss.
Complete Endevco system qualifies to Mil E-5272. Temperature range −40°F to +230°F. Frequency response from below 10 cps to above 10 KC. Entire system isolated from ground.
Endevco System Amplifiers and Transducers are described in the "2200" and "2600" literature. Write for your copies today.
dynamic instrumentation
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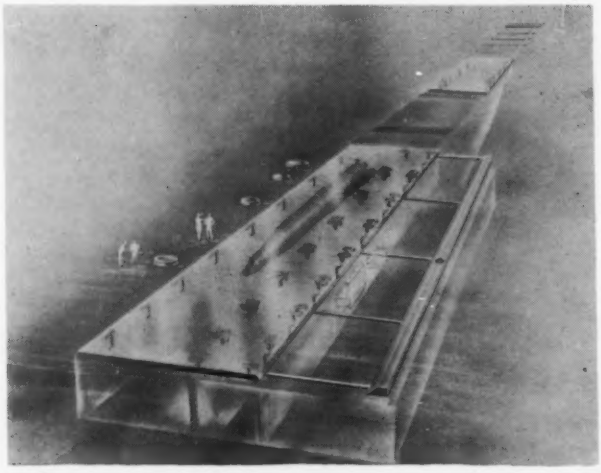
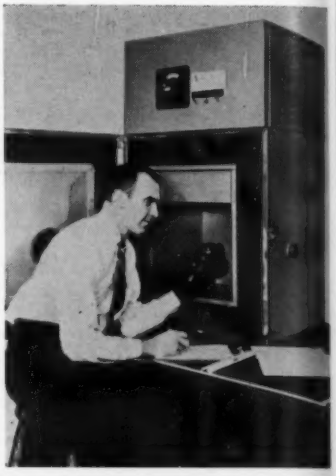
Department M
161 East California Boulevard
Pasadena, California

Environmental Quarterly's Album of People, Products, Places and Ideas...

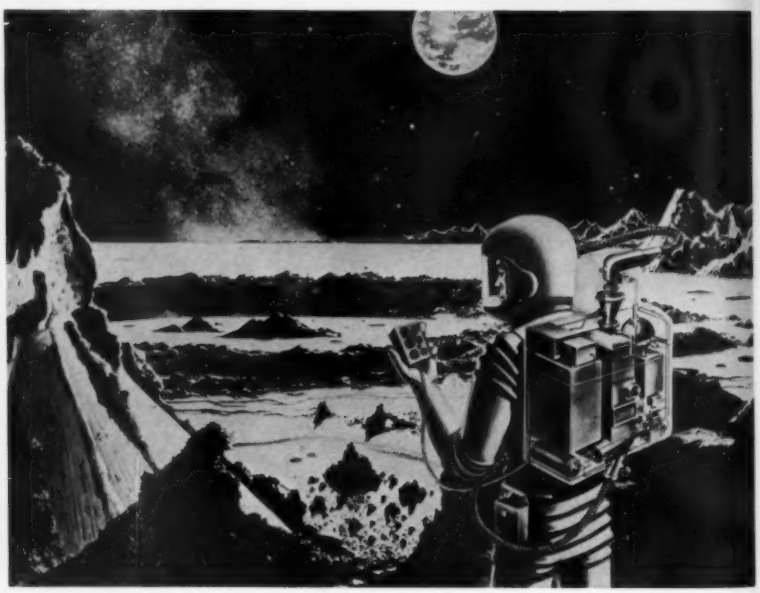


POWER PLUS in hydraulic systems (rendered at left) by The Rucker Company for 15 ICBM launching sites will handle 800,000-lb. concrete, blast resistant overhead doors of underground silos. (Circle EQ RSC C)



A NEW LINE of environmental chambers by International Radiant Corp. includes the ValuMite (right), mechanically cooled (—100° F.) and electrically heated (+250° F.) two cubic-footer (Circle EQ RSC D)

LOOK, MA, this ejection seat (above) has fins by Hexcel Products Corp. to straighten me up and fly me right before my chute opens if I bail out of an X-15. And get that flying suit—my own pressurized cabin environment. (Circle EQ RSC E)



MOON PACK is the name given by Garrett Corp.'s AiResearch Mfg. division to the rig this voyageur (above) is wearing to simulate a livable environment in space, where pressure is too low to sustain life. The oxygen system weighs 50 pounds down here but is reputed to be weightless out yonder. (Circle EQ RSC F)

TROPHY FOR TENNEY from the New Jersey Wing of the Air Force Assn. is accepted by Monroe Seligman (standing at right in photo at left) for Tenney Engineering, Inc. The "Air Power" trophy honored Tenney for the stratosphere chamber it is making for Republic. (Circle EQ RSC G)

DONALD L. WRISLEY (right) has formed his own consulting company. (See Environmental Business)

LOW COST CENTRIFUGE

for large-quantity acceleration test programs

Genisco Model A903 features simplified operating procedures; rugged construction...for fast, accurate testing to MIL-E-5272A, Procedure II

Although the A903 is a simple, low cost centrifuge, it has many features found in more sophisticated machines, *plus* unique features which particularly suit it for production-line testing and evaluation programs.

SIMPLE OPERATION—Except for an on-off switch, controls are limited to a single handwheel which controls table speed. Chance of human error is reduced to a minimum. Test personnel can learn its operation in minutes.

SPEEDS TESTING—24" diameter mounting-table will accommodate several test objects. Arranged symmetrically, they can be subjected to acceleration forces simultaneously.

RUGGEDLY-BUILT—Virtually immune to operational abuse. Will operate for long periods without maintenance as demanded for production test programs.

0.5% ACCURACY—Constancy of rotation of the mounting-table is within 0.5%, including wow and drift. Table rotation speed can be measured electronically within ±1 count.

BRIEF SPECIFICATIONS

G-Range: 1 to 1,000 g's in five standard ranges, infinitely variable

G-Pound Capacity: 2,500 g pounds, maximum

Constancy of Rotation:

- **Wow:** 0.5%, maximum
- **Drift:** 0.2% of rate per minute, maximum

Speed Indication Accuracy:

- **Tachometer:** ±1¼%
- **Magnetic Pickoffs:** 60 tooth pickoff gear standard; 600 tooth gear optional. Pulses are fed to a front panel coaxial receptacle for use with any standard electronic counter.

Vibration Isolation: 0.1 g in any plane, at any speed

Test Object Dimensions: 8" high (24" diameter circular platform)

Slip Rings: 8 standard, 10 amp. maximum

Write for complete technical information and prices.

Genisco INCORPORATED

2233 FEDERAL AVENUE • LOS ANGELES 64 • CALIFORNIA

ENVIRONMENTS IN USE...

Intermediate Heat Transfer Fluid Chamber

The Problem: Eclipse-Pioneer division of Bendix Aviation Corp. for various reasons preferred liquid CO_2 cooling for a chamber to accommodate a shaker for testing a high capacity water-generator set used in missiles and aircraft. But carbon brushes on the commutator and slip rings of the motor generator set would not function properly in the carbon dioxide atmosphere of a direct injection chamber.

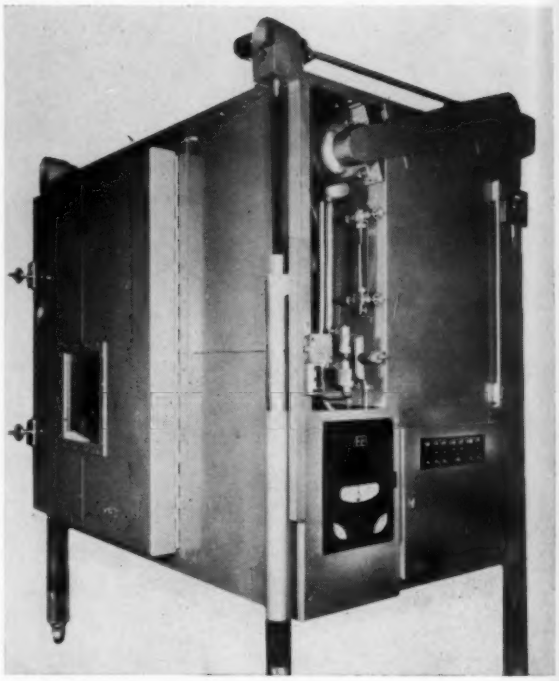
THE SOLUTION: To use liquid CO_2 as a primary refrigerant without causing a CO_2 atmosphere, Standard Cabinet Company, Inc., Carlstadt, N. J., incorporated an intermediate heat transfer fluid coil into a chamber. Trichlorethylene was selected as the fluid because of its ready availability and high boiling point and because it would not corrode copper, brass and other materials in the coil, storage tank piping and fittings.

Basically, the cooling system consists of a tank about half filled with trichlorethylene, a pump, cooling coil, piping and a three-way pneumatic bypass valve actuated by a controller. The valve bypasses the fluid around the coil, back to the storage tank, to maintain desired chamber temperature.

Liquid CO_2 is injected directly into the fluid storage tank via a set of nozzles near the bottom. Flow of the refrigerant through the nozzles is controlled by two solenoid valves: only one is used for low rate cooling; both are used for rapid cooling or heavy load conditions. With an auxiliary thermostat, the flow of CO_2 through the injection nozzles is limited to the smallest quantity required to maintain the desired temperature.

As the circulating fluid system is not used for temperatures above ambient, conventional electric heaters are installed in the chamber. Gravity drains the coils and piping whenever the circulating pump is stopped.

In position, the chamber requires only connecting the CO_2, power, compressed air and a vapor vent to carry off expended carbon dioxide vapor and trichlorethylene vapor carried over by the CO_2. Connections are made with quick-disconnect type fittings and flexible electric cables.



Unique liquid CO_2 high-low temperature vibration test chamber by Standard Cabinet Co. for Eclipse-Pioneer division utilizes intermediate heat transfer fluid coil. Interior work space is 4' x 4' x 4'. Access ports of 2' x 2' in bottom and back to accommodate shaker head in vertical or horizontal planes are sealed with silicone rubber diaphragms. Motorized screw jack system sets the chamber at desired height; casters make it possible for two men to move it.

This type of system, says Standard Cabinet, can be used in either small or large chambers with vibration exciters or in conventional test chambers. The system is also applicable to altitude chambers when it is impractical to inject CO_2 directly because of the pumping capacity needed to remove vapor to maintain the altitude condition.

The system may also be used as a booster for a mechanical refrigeration chamber when there is a heavy live load of transient nature, or when rapid pull down is called for.

Standard Cabinet cites the example of a 27-cubic-foot cabinet it supplied with a 40 hp refrigeration system to dissipate a 6,000-watt live load and maintain a temperature of —100° F. Except for the 10 minutes a day during which the live load was under test, a 10 hp. system could have handled the job easily. It is estimated that with an indirect liquid CO_2 system as an adjunct to a 10 hp direct expansion cascade system, a saving about 25 per cent could have been realized in the initial cost of the equipment.

THERMOSEAL

. . . viewing glass units for environmental chambers. Tolerates —100° to +350° F differential. Prompt deliveries.

. . . *tempered glass units and tempered glass now available for rapid delivery.*

We also offer engineering service.

THERMOSEAL GLASS CORPORATION

P.O. Box 342 • Camden, N. J.

Advanced Vibration Tests for X-15 Valves

The Problem: Testing gaseous oxygen valves for the X-15 manned space vehicle at Telecomputing Corp.'s Whittaker Engineering Laboratories required simulating actual operating conditions of temperature, pressure, humidity and vibration. Exposing the test specimen to sinusoidal vibration during functional testing was a major requirement to insure accurate and reliable service.

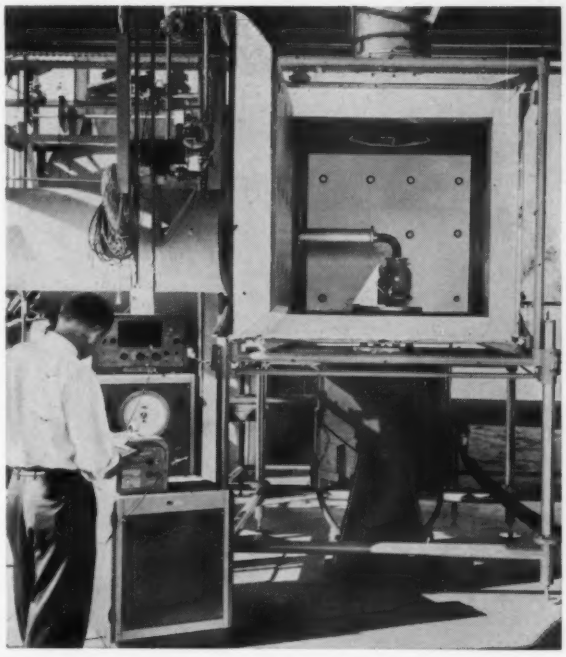
THE SOLUTION: The valve has a complex triple function. It serves to vent gas formed as the LOX tank is filled. It is a relief valve during flight. And it is a dumping valve during an emergency. Its structural integrity is critical.

A test first used for the LOX system of a major ICBM was installed. It encompasses combined environments in which the valve, mounted in an environmental chamber is attached to an electrodynamic shaker. Sinusoidal vibration is applied by a Ling Electronics vibration power generator.

A special 5,000 force pound shaker is used, and a cycling oscillator excites the valve through a full range of frequencies as the temperature in the chamber drops.

Accelerometers mounted to the shaker table provide electrical signals of the forces being applied to the specimen. The signals are fed into a Ling servo system which holds table acceleration or displacement constant while cycling through the sine wave frequencies. The signal also is monitored on meters and an oscilloscope to maintain accurate output levels—within predetermined acceleration or displacement limits.

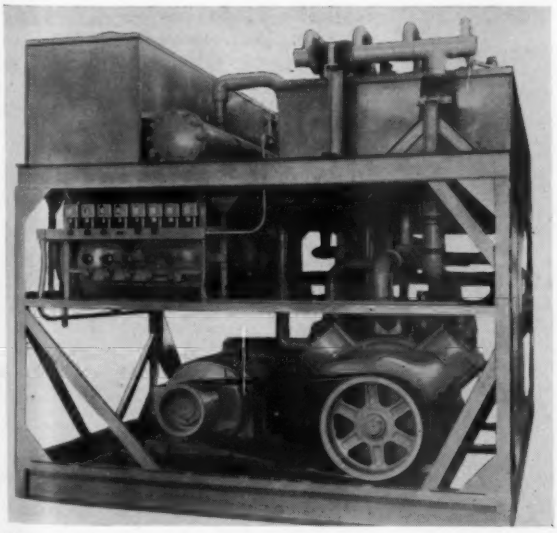
Testing under vibrational conditions gives data on mounting and structural integrity as well as on the basic valve action. According to A. L. Spangenberg, director of the Whittaker labs, combined environmental technique insures optimum effectiveness of development tests and is establishing the first adequate qualification standards for gaseous oxygen service.



A Ling Electronics vibration power generator, Model PP40/40, provides up to 5,000 force pounds over a frequency range of 5 to 5,000 cps in combined environments testing of X-15 gaseous oxygen valves at Whittaker Engineering Laboratories.

Deep Freezer for a B-70 Wing Section

The Problem: At its Columbus, Ohio plant, North American Aviation needed an extra large cold bath as part of the relatively new technique of fabricating wing sections by honeycomb brazing. The plant is in the B-70 program.



Tenney Engineering, Inc., designed this refrigeration system to produce —120° F. temperatures for the cold tank of a honeycomb brazing process at North American Aviation's Columbus plant.

THE SOLUTION: A deep freeze the size of a living room was designed by Tenney Engineering, Inc., Union, N. J., and installed below ground at the Columbus plant site. A ground-level lid opens to accept parts as big as 11' x 21' x 5'. Nearby is refrigeration equipment capable of producing —120° F.

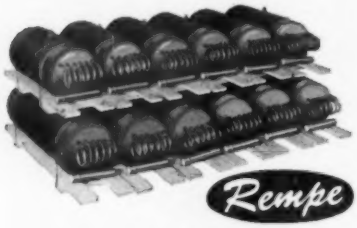
The tank is a brine chiller 16' x 26' x 7'. Thought to be the first of its size ever fabricated, it was constructed to process a mass load of 14,000 pounds in about 150,000 pounds of methylene chloride brine.

After being brazed at 1650 degrees, the wing section, a honeycomb structure sandwiched between stainless steel plates, is air cooled to 100 degrees and then frozen. The extreme cold bath is said to harden and stabilize the metals.

The North American equipment cost $140,000. Tenney has announced receipt of a contract for a similar brine chiller, also costing $140,000 for Chance Vought Aircraft, Inc., in Dallas. The latter unit will be slightly smaller overall, but it will produce the same temperatures and will handle a mass load of 22,000 pounds. The difference is explained by the fact that the C-V wings sections will be in graphite forms while being brazed.

REMPE
Heat Transfer Equipment

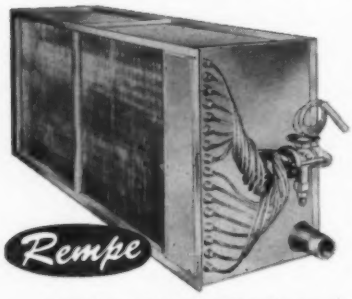
CASCADE CONDENSERS



For Low Temperature Refrigeration Systems

Ideally suited for all low temperature work. Illustration shows shipment of 12"x60" Cascades—sizes available from 6" to 30" diameters. Refrigerant vapor condenses in shell. Internal fin coil carries a second refrigerant. Also suitable for low temperature Glycol chilling down to minus 100° F.

STAINLESS STEEL — FIN TYPE
COOLING COILS



For Corrosive Atmosphere

Rempe Stainless Steel Cooling Coils can be furnished of gas-tight construction as illustrated for handling air contaminated with varying concentrations of acid vapors. Ideally suited for all types of corrosive air mixtures, gas or liquid cooling requirements. Details on request.

Engineering Data Book
Pipe Coil and Fin Coil Designs. Heat Transfer Coefficients. Get a copy for your library.

REMPE COMPANY
366 N. Sacramento Blvd. ■ Chicago 12, Ill.

People You Know...

CHANGING ENVIRONMENTS

Tenney Promotes Shapiro, Gottesman and Stackhouse

Shapiro

Three top promotions were announced recently at Tenney Engineering, Inc., manufacturer of environmental chambers and heat transfer components — a vice president, secretary and treasurer.

Sid Shapiro now directs as a vice president the expanded heat transfer components division he headed as sales manager. Shapiro, who joined Tenney in 1945, will keep his office at company headquarters in Union, N. J.

Walter Gottesman and Raymond Stackhouse are the new Tenney secretary and treasurer, respectively. They were assistants in those posts when Saul S. Schiffman, board chairman, also served as secretary-treasurer. He continues as chief financial officer.

Gottesman

Stackhouse

Gottesman has been with Tenney seven years, Stackhouse, 22.

Two Executives Named At Barry Controls, Inc.

Chivers

Lowe

A. S. "Mike" Chivers and Russell Lowe have received promotions and new assignments in an executive streamlining at Barry Controls, Inc., major manufacturer of engineered products for control of dynamic environments such as shock, vibration and noise.

Chivers, manager of the Western division at Burbank, Calif., took over the newly created post of manager of the Watertown, Mass., division.

Lowe, chief engineer at Watertown, was promoted to Chivers' job at Burbank.

Both men joined Barry in 1952, and both held their former jobs since 1956.

CHESTER H. JOHNSON has been appointed manager of public relations for VARIAN ASSOCIATES working under personnel and public relations Director DONALD A. RUTLEDGE. He was formerly administrative assistant to the general manager.

* * *

RUDOLPH J. NAPOLITAN, formerly general sales manager of A.R.F. Products, Inc., and assistant general sales manager of Permoflux Corporation, has been chosen general manager of the NATIONAL ELECTRONICS CONFERENCE.

* * *

RALPH B. AUSTRIAN has joined PACKARD BELL ELECTRONICS as sales and marketing director of its Magnetics Laboratory. Austrian was formerly sales manager of Ling Electronics' Vibration division.

* * *

HAROLD P. KATHERMAN joins S-F-D LABORATORIES, INC., Union, N. J., a subsidiary of Varian Associates, as controller and general business manager. He was previously assistant to the president and controller of Sparton Corp.

* * *

GEORGE W. CLAPP has been promoted to sales manager of UNITED ELECTRIC CONTROLS CO., manufacturer of temperature and pressure controls. Previously a sales engineer and account manager, he has been with the Watertown, Mass., firm since 1951.

* * *

JOHN R. MORTON has been appointed production engineering manager for the Whittaker Controls Division of TELECOMPUTING CORPORATION. He formerly held a similar post with Bourns, Inc.

* * *

JOHN E. SCHMITZ, former research and development specialist in the engineering laboratories of North American Aviation's Autonetics Division has been appointed general manager and chief engineer of the recently formed chemical division of ELECTRONIC PRODUCTION & DEVELOPMENT, INC., Hawthorne, Cal.

* * *

STRASSBERG-KAFTAN NUPTIALS

Wedding bells rang Dec. 5 for Howard Strassberg, chief environmental engineer for Belock Instrument Corp., College Point, N. Y., and Miss Liela Kaftan, of New York. The wedding took place at the Concourse Plaza Hotel, The Bronx.

Trager

Smith

S. C. TRAGER has been appointed manager of PURE CARBONIC COMPANY'S distribution department. He was formerly assistant to the vice-president, distribution, for the New York-based company, which makes and sells CO_2 nationally in gas, liquid and solid forms. Trager has been with Pureco since 1951.

* * *

FARRIS W. SMITH has been appointed design and development engineer for the L.A.B. CORPORATION, Skaneateles, N. Y. Formerly vice president and manager of the Hawkeye Products Corporation, Smith will also serve as L.A.B.'s manager of customer service.

Gross

Jones

HOWARD C. JONES and **MALVERN J. GROSS** were named assistant to the president and director of manufacturing, respectively, for CONSOLIDATED VACUUM CORPORATION, Rochester, N. Y. Jones, who joined CVC in 1955, moves into a newly created post to work on long-range planning. Gross takes over Jones' former job. He joined CVC in 1956.

* * *

WALTER PLYWASKI has joined THE MARTIN COMPANY, Denver division, as environmental test standards engineer. He was previously R & D electronics engineer with Hamilton-Hathway in Denver.

Plywaski

Gunnarson

Gunnarson Is MB Manager

John A. Gunnarson has been appointed to the newly created position of general manager, MB Electronics division of Textron Electronics. He will be responsible for the division's two New Haven plants.

DO YOU HAVE A NEW COMPONENT, ASSEMBLY OR END ITEM THAT MUST MEET SOME REQUIREMENT IN ENVIRONMENT?

Acton Laboratories, Inc., offers an environmental testing *service*, meeting both commercial and military specifications, to companies: (1) requiring independent certification of tests, (2) not in a position to justify the purchase of expensive environmental equipment, (3) whose own environmental facilities are in use on other projects.

Our facilities, engineers, and teohnicians are available to conduct the entire tests; or you may use our facilities and provide your own engineers or technicians to conduet the performance tests.

For information telephone or write:

ALI

LITERATURE FOR ENVIRONMENT...

Bemco Inc., North Hollywood, Calif., describes its wide range of chambers—refrigerated, alt-hum, sand-dust, salt spray, dry ice, sun-rain, and including such specialties as fungus and explosion chambers—in an 18-page, glossy covered catalog. **(Circle EQ RSC #38)**

* * *

Pure Carbonic Company, New York, has a six-page, two-color brochure on carbon dioxide low temperature environmental testing. It describes the four principal methods used and the various supply systems it offers. **(Circle EQ RSC #39)**

* * *

Avco Research and Advanced Development Division, Wilmington, Mass., in a four-page, two-color bulletin gives technical details on its new 166 db acoustic noise generator for creating high intensity noise environments equivalent to rocket or jet engines. **(Circle EQ RSC #40)**

* * *

Unholtz-Dickie Corporation, Hamden, Conn., gives detailed specifications and applications for its new, compact Dial-A-Gain in a single-sheet flyer. The precision instrument standardizes accelerometer output in vibration measurements. **(Circle EQ RSC #41)**

General Electric Co.'s. Missile and Space Department, Philadelphia, has issued a challenging booklet seeking to show there is a mathematical basis for predicting the point of physical failure. Containing 22 diagrams, it is aimed at solving problems of missile reliability. **(Circle EQ RSC #42)**

The department also gives a comprehensive description of the advanced work at the aerosciences laboratory in a 20-page, profusely-illustrated booklet. It aso contains an unusual, crystal-clear picture of the moon made from many composite photos. **(Circle EQ RSC #43)**

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itemco Inc., Port Washington, N. Y., has a spec sheet out on its new Model Tempest 1 chamber for sand and dust testing up to 2300 fpm. **(Circle EQ RSC #44)**

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Panoramic Radio Products, Inc., Mount Vernon, N. Y., publishes a 12-page, two-color illustrated catalog digest of its line of automatic spectrum analyzers, response curve tracers and new instrumentation systems. **(Circle EQ RSC #45)**

* * *

Reynolds Metals Co., Richmond, Va., discusses methods of adhesive bonding of aluminum in a helpful 20-page booklet. Various types of adhesives and best joint design on structural work are covered.. Applications include panel-bonding for supersonic aircraft fuselages. **(Circle EQ RSC #46)**

* * *

Consolidated Systems Corp., Pasadena, Calif., has a colorful, four-page Bulletin 3020 on wind tunnel testing and the instrumentation needed for acquiring and processing data obtained. Actual instrumentation of a high-speed tunnel is described. **(Circle EQ RSC #47)**

* * *

Horkey-Moore Associates, Torrance, Calif., give a quick rundown on its testing division's facilities in a four-page, two-color, graphically-illustrated brochure. Environmental testing of every kind of component to meet all commercial or military specs is offered. **(Circle EQ RSC #48)**

* * *

Tenney Engineering, Inc., Union, N. J., pictures and describes the many applications of its walk-in space chambers in a new two-color brochure. The chambers range up to altitudes of 1,500,000 feet, temperatures from —150° to +2,000° F., humidity to 95 per cent, rainfall to 24 in. per hour and solar radiation to 140 watts per square foot. **(Circle EQ RSC #49)**

* * *

Consolidated Vacuum Corporation, Rochester, N. Y., discusses the field of vacuum technology and the Roots high vacuum pumps it markets in a 16-page booklet, punched for ring binding. The various principal vacuum ranges and the types of pumps best suited for each are analyzed. **(Circle EQ RSC #50)**

* * *

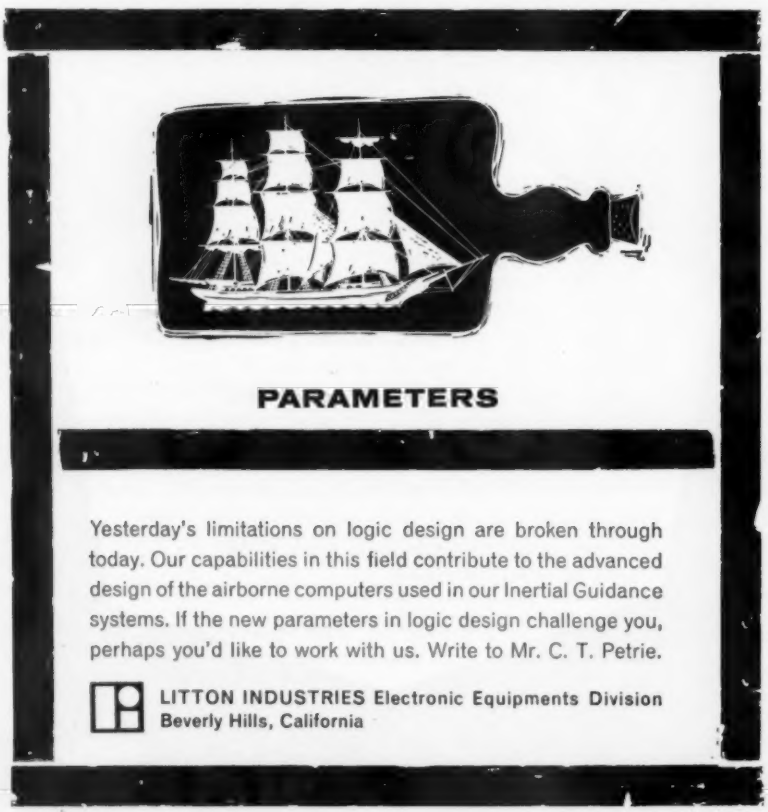
Barry Controls, Inc., Watertown, Mass., offers a data bulletin on its isolators for shock, vibration and noise caused by impact, rotating and reciprocating machines. Load ratings and curves are shown on the bulletin, which is punched for ring binding. **(Circle EQ RSC #51)**

* * *

Blue M Electric Company, Blue Island, Ill., lists its special line of Ultra-temp (1200°F.) ovens as well as ovens up to 1300°F. and ranging from 1 cubic foot to 36 cubic feet in a four-page, two-color brochure. Construction details, prices, sizes and voltages are included. **(Circle EQ RSC #52)**

* * *

Flexonics Research Laboratories, Elgin, Ill., describes its test facilities and services in a well illustrated catalogue, bound in stiff blue cardboard. The laboratories deal in applied research, product development, hydraulics, pneumatics, matallurgy, physical and climatic environments and structural dynamics. **(Circle EQ RSC #53.)**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Government Publications

Almost daily the U. S. Department of Commerce releases a number of technical reports for use by industry. These documents are sold through the department's Office of Technical Services, Washington 25, D. C. Here are some recent releases and their prices:

(ONR—Office of Naval Research)
(WADC—Wright Air Development Center)

Materials in Space Environment: Proceedings of the Fifth Sagamore Ordnance Materials Research Conference, Office of Ordnance Research. Problems of materials in space as discussed in 18 lectures and informal debates at the Sept., 1958 conference. Deals with radiation effects, thermal problems, meteorites and cosmic dust and physics of space vacuum. 276 pages. Order No. PB 151900, $4.

Basic Research in the Navy, by Arthur D. Little, Inc., for the Naval Research Advisory Committee, ONR. Measures the amount of basic research being done, its aim and structure. Based on the findings of a two-year investigation of work by industry, government and universities, it has been dubbed "research on research." 189 pages in two volumes. Order No. PB 151925, $7.

Bibliographical Review of Panel Flutter and Effects of Aerodynamic Noise, by J. V. Rattayya and L. E. Goodman, University of Minnesota for WADC. More than 200 published studies from the U. S., Russia, England and France are summarized and criticized in an investigation of acoustical fatigue of aircraft panels. 42 pages. Order No. PB 151890, $1.25.

A Statistical Method for the Extraction of Stability Parameters from Flight Test Data, by M. N. Springer, Massachusetts Institute of Technology, for WADC. Evaluation from flight-test and other experimental data of the forces and moments acting on an aircraft. 101 pages. Order No. PB 151901, $2.50.

Shock-Wave Oscillations in Supersonic Flow, by J. W. Ellinwood, L. Trilling and J. F. White, MIT, for WADC. Interaction of a shock wave with a laminar boundary, designing and testing a wind tunnel generator of oscillating waves, and unsteady aerodynamic forces and critical airfoil frequencies under oscillation are discussed in three studies. 68 pages. Order No. PB 151902, $1.75.

Development of New Sound Absorbing Materials for Noise Suppressors, by Armour Research Foundation for WADC. Part I of a study to measure high-temperature acoustical and mechanical properties of absorbing materials in aircraft engine test cells. Materials tested included ceramics, glass wool and impregnated fibers. 74 pages. Order No. PB 151907, $2.

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Cold Treatment: New Tool

The extreme cold environmental engineers produce to test reliability has an important industrial application. Metallurgists have found that cold treatment at −120° to −150° F. completes the hardening process that occurs when steel is heated and quenched, resulting in harder, longer wearing, more stable parts.

by Rolland S. Jamison
Sales Manager,
Harris Refrigeration Co.

THE TECHNIQUE OF SUBJECTING steel to cold is not as new as it may sound. The old Swiss watchmakers used to store parts on the icy peaks of the Alps for a year or more, to "age" them. The difference is that today modern refrigeration, at temperatures far below those of the coldest and highest mountains, can accomplish the same thing in a matter of hours, more surely and more precisely.

Low temperature treatment is already meeting a variety of production requirements, and new applications for the technique are being discovered almost every month. Amazing results have been recorded in insuring dimensional stability in critical components, in effecting hardness for long wear and in cutting costs for further processing by establishing new standards of control for consistent hardness and ductility.

Stabilization, Shrink-fitting

One of the widest present applications for cold treatment is for the stabilization of gages and precision parts. Another important application is in shrink-fitting — — for example, an inner ball bearing race is cooled while the outer races are heated to facilitate loading the balls or rollers.

Tool manufacturers use the technique to control hardness and to increase several times the useful life of tools and dies, and bearing manufacturers chill for hardness control and to achieve dimensional stability.

Non-ferrous materials are also cold-treated successfully. One company was able to reduce a three-stage machining operation on an aluminum casting to one stage by heat-treating and chilling prior to machining, and the saving on a single order reached nearly $40,000. In the aircraft and missile field promising results have been achieved with precipitation-hardening of aluminum.

Size Matters Not

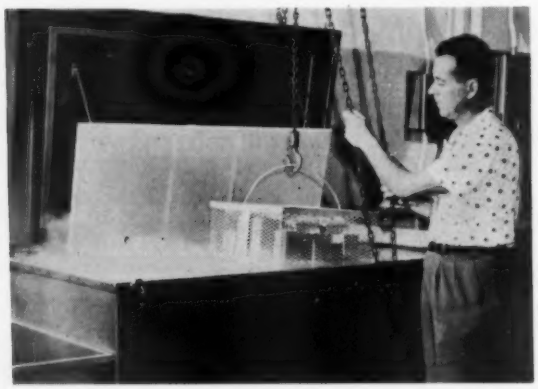
Size is no problem; cold treatment is being applied to ball bearings 1,000 of which weigh slightly over three ounces, and to a 10-ton, 20-foot long mill roll for which a special chamber had to be built.

Tools and gages used by the Hoover Vacuum Cleaner Co., North Canton, Ohio are cold treated after tempering. While hardness of only Rockwell C-52 to 60 is often revealed after tempering at only 300°-350° F., a super-chill treatment increases this hardness by several points. New York Air Brake's Watertown Division has relied on chilling for more than three years to achieve dimensional stability in critical components.

Raytheon Manufacturing Co. is one of a number of manufacturers who use chilling machines for environmental testing of components. A less well-known application of chilling machines occurs at Miniature Precision Bearings, Inc., whose bearings must maintain complete dimensional stability at temperatures varying from −65° to +150° F. The cold treatment minimizes molecular rearrangement within the bearings; it is also used to process various alloy tool steel and high speed steel for tools and gages.

Three Types of Systems

Three types of chilling systems are in operation and can be adapted to many production requirements. The actual



SHOCK FOR TRANSFORMERS: A basket of transformers is being lowered into a Harris Model 2832-126 chiller at Raytheon Manufacturing Co., Waltham, Mass., to test for ability to withstand severe and abrupt changes in temperature. Baffle door in chamber provides extra insulation for mechanically convected air.

# of Industry

Jamison

Rolland S. Jamison is a recognized authority on low temperature refrigeration. In 1954 he delivered a paper at the 22nd annual meeting of the American Society of Tool Engineers entitled "Sub-Zero Chilling as an Industrial Process." The ideas he presented are being widely used today, and the society recently asked him to rewrite the section of its handbook on shrink fitting. Formerly assistant to the president of Cincinnati Sub-Zero Products, he joined Harris Refrigeration early in 1957 to administer a national marketing and publicity program. He was named Harris' sales manager a year ago and moved from Cincinnati to Cambridge, Mass., to be at headquarters.

design of a system depends, of course, on the sizes of parts to be processed, the necessary rate of output and the required temperature range. The systems described, therefore, represent principles of operation and are not intended as blueprints.

One system depends on circulating refrigerated air; the other two are liquid systems—one for small batches and the other for production line outputs.

The first has a large chilling chamber, from 10 cu. ft. up to 250 cu. ft. A sheet metal basket holds medium-size parts 2 to 8 inches in diameter. Mechanical convection within the chamber draws the air stream through the parts in the basket and passes the air directly over the refrigeration coils to remove heat. This provides direct, rapid and uniform refrigeration of the parts. For larger objects the basket may be removed and the parts placed directly in the chamber.

Liquid Convection Type

In one of the other systems, a mesh basket holds small parts in a liquid convection fluid for quick and thorough chilling. This type of system is required for small components such as bearing balls, penpoints and a great variety of small tools.

A propeller keeps the liquid in constant agitation to insure uniform contact with all the contents of the basket. Positive-acting, the propeller revolves in a baffled tube to produce uniform circulation and to avoid mere swirling, thus maintaining maximum efficiency in convection of heat through the liquid.

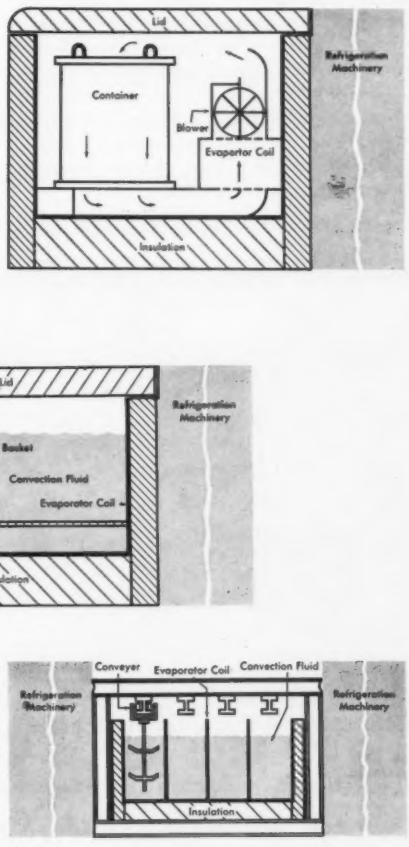
Various hydrocarbons are used as fluids, including "Genetron-11," by Allied Chemical and Dye Co., du Pont's "Freon-11," methylene chloride, acetone and alcohols. The last two must be handled carefully, due to their inflammable nature.

The circulating air and mesh basket-liquid convection systems are batch types. The third system uses a conveyor for large quantity, economical, rapid production. The chilling chamber, 8 feet wide and 30 feet long, provides for four passes of each part, or 100 feet of travel, in the convection liquid.

Advantage Over Air Chilling

Liquid has an advantage over air chilling because it can be isolated with relative ease from outside air. Excessive quantities of heat would be introduced at the conveyor entrance and discharge ports with an air system. Liquid sys-

(Continued on Page 30)



CHILLERS, ALL: Schematic diagrams at right illustrate three types of chilling systems. Top—batch-type that depends on circulating refrigerated air. Center—Liquid convection system for small parts held in a metal basket. Bottom—Liquid convection system with a conveyor for larger production needs. (Diagrams courtesy of Metal Progress magazine.)

Industrial Cold Treatment

(*Continued from Page* 29)

tems of this type are now in use for cold treatment on a production basis, handling daily thousands of parts weighing 10 pounds or more each.

All three systems are built with thermal capacities to handle 100, 250 and 500 pounds per hour. One in the design stage can handle 5,000 pounds per hour. Theoretically there is no limit to the job that can be performed by these systems either in attaining practical temperature ranges, or in size of parts processed or rate of output.

Assuming that the proper system and chilling unit has been installed for the job, analysis will reveal a cost of only a small fraction of a cent per pound for cold treatment. The cost is far more than offset by the later production economies that result and the higher selling price warranted by improved wearing qualities.

Just as high frequency wavelengths have revealed new qualities in the reproduction of sound, the application of the other end of the temperature scale is providing control of metal properties hitherto unattainable by normal heat treating. The process of chilling has been in general use for only a few years. Its ultimate effect on industrial and consumer products in terms of longer wear is as yet incalculable. We are only on the threshold of the broad application of chilling in the jet engine, missile and satellite fields. The further application of chilling to non-ferrous materials remains one of the exciting engineering adventures of the next decade.

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R.F. Interference Test

(*Continued from Page* 15)

The combined environments of low temperature and altitude affected the propagation of the radio interference generated by the blower motor test specimen to such an extent as to produce results completely unrelated to the data gathered during the elevated temperature-humidity tests. A comparison of the results shows that the signal amplitude and frequency characteristics were not appreciably affected, due to the pressure change equivalent to 20,000 feet, or the temperature change from −12° F. to −67° F., or the combination of the two environments.

Ambient Reference Decreases

In comparing this data with the ambient reference, it is noted that at .150 mc the amplitude is essentially the same. However, the ambient reference decreases gradually to a minimum amplitude of 42 db at 10 mc, whereas the low temperature-altitude curve drops sharply to a minimum of 32 db at 3 mc and maintains this level until it assumes the same frequency and approximate amplitude characteristics as the ambient reference up to 25 mc. At this point, no correlation of the two curves exists.

The ambient reference decreases in amplitude at a steady rate from 63 db at 25 mc to about 14 db at 1,000 mc, while the low temperature-altitude curve shows a major resonant condition peaking at 138 mc with an amplitude level of 72 db, decreasing to 38 db at 400 mc with a sharp increase to 62 db in the 1,000 mc region. The most peculiar change is the decrease of the RF noise level below that of the ambient reference between 1 and 15 mc.

Elevated Temperature and Altitude

The elevated temperature-altitude requirements for components of a XQ-4 type target drone have been defined as a combined environment of 200° F. and a pressure of 1.32 inches/mercury abs (70,000 feet). Due to the limits of the chamber employed in these tests, the environment was established at 200° F. at a pressure of 3.44 inches/mercury abs (50,000 feet). After stabilization, the test specimen was to operate satisfactorily.

Again the test specimen was mounted and internal pressure and temperature were set. With the specimen operating in this environment, a series of radiated noise measurements were made.

The data from the elevated temperature-altitude test indicates characteristics very similar to those encountered during the low temperature-altitude test with only slight variations in amplitude. The amplitude of the RF noise detected between 1 mc and 15 mc does not differ greatly from the ambient reference as did the low temperature-altitude data.

Conclusions of the Study

The study, though limited, showed that laboratory measurements of radio interferences in an "ambient" environment do not guarantee satisfactory operation when the noise source is exposed to extreme environments. Since only the effect was brought out, further studies must be made to determine the basic cause of variations of noise amplitude and frequency. These should find out if the effects are due to a particular environment, or a combination of environments, and if the variations are the result of internal electrical characteristics changing with the environments, or if they are associated with other supporting equipment, such as antennas, stabilization networks, cables and external wiring.

Yardstick for Environment

(Continued from Page 18)

n a jet stream against the heat dissipating objects, 1020 cfm nominal flow is indicated for the air to have a 20° F. rise at sea level altitude and 70° F. At 100,000 feet, 142,000 cfm would be required for the same 20° rise.

Overcoming An Impracticality

Obviously it is impractical to provide for all of the air circulated to be in an ideal jet stream and to be impinged upon those areas and surfaces in which there is heat exchange. A basic design factor in the range of 2 to 100 should be applied, depending upon the facility size and configuration, to provide minimum mass air movement at design altitude levels for practical utility of the test facility. This design factor does not include safety factor in accommodating the items of application such as fan efficiency, air circuit pressure drop, heat exchanger pressure drop, and so forth.

The following table gives the minimum cfm or air required to accommodate the arbitrary dissipated load of 17,000 BTU/hr, based on assuming a theoretical jet air stream ideally directed at the heat-dissipating objects taking a 20° F. rise.

Altitude	For −100° F. Operation	For +350° F. Operation
70,000'	12,700 cfm	28,500 cfm
100,000'	51,000 cfm	115,000 cfm
125,000'	152,000 cfm	342,000 cfm
150,000'	427,000 cfm	960,000 cfm

This points up the fact that the problem of air handling becomes critical above 50,000 ft. At this time, it is considered unfeasible to design for significent mass air flow, required for temperature control, above 100,000 feet. At very high altitudes temperature control should be attained by controlling product temperature rather than attempting control of the environment or ambient "air" circulating about the test item. Temperature stabilization is achieved through use of cold or hot radiating heat exchange sinks.

Combined Vibration-Temperature

In testing under the combined environments of vibration and temperature, the shaker head or slippery table to which a specimen or fixture is mounted is a heat sink which in some cases can significantly influence the temperature of the test item. In all cases, the temperature of the test item should be monitored independently of the temperature of the environment. In some cases it may be necessary to utilize a thermal barrier or temperature controlled mounting plate to properly establish product temperatures when they are mounted directly to the head or table of a large mass.

The examples point up what must be done. The environmental practitioner should ideally be exposed to a training program similar to an internship to develop the skills so necessary to the correct practice of his art. In a similar manner, the equipment supplier should be obligated to avoid inherent equipment deficiencies by meeting proper standards of performance.

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Deadline for April, 1960, issue is Feb. 10, 1960. Send order, copy, payment and all inquiries to Environmental Want Ads, Environmental Quarterly, P. O. Box 2583, Grand Central Station, New York 17, N. Y.

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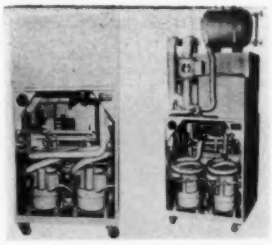
NEW PRODUCTS...

A "Reader Service Card" requiring no postage is bound into this issue for the convenience of those desiring additional information on new products, new literature (Page 26 and other announcements. It is keyed in the text as "EQ RSC.")

PORTABLE, PACKAGED REMOTE SUPPLIES OF LOW TEMPS to —120° are available from 12 models of **Tenney Engineering, Inc.'s** new line of **Kold Paks,** one-piece mechanical refrigeration assemblies that can be rolled right up to the work space for original or supplemental refrigeration. Both direct expansion types (at left in the picture), with freon passing through a user's heat exchanger, and brine chiller (at right in the picture), with a liquid acting as secondary cooling agent. Can handle 3,240 to 34,000 BTU/hr at —40° F. (brine) or —60° F. (evaporator) temps. At —100° (brine) or —120° (evaporator), capacity ranges from 660 to 7,000 BTU/hr. Applications: rapid temp changes in testing and in production for adaption to low temp baths, cold traps (vacuum equipment), quenching baths and metal treatment. Provide refrigeration to a "hot" zone in atomic energy areas without endangering personnel.



For More Information Circle EQ RSC #1

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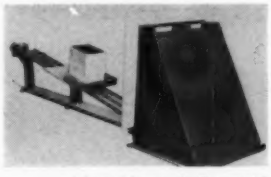
TRANSPORTATION SIMULATOR, Type 400-CM-116, by **L.A.B. Corporation,** provides impact tests for small appliances, packages and components up to 400 lbs. Using the incline-impact principle, the dolly is rubber mounted, and quieter testing can also be achieved with ballast using an optional enclosed barrier of shock-absorbing longitudinal steel plates. A 1" thick sheet of plywood forms the barrier striking face.



For More Information Circle EQ RSC #2

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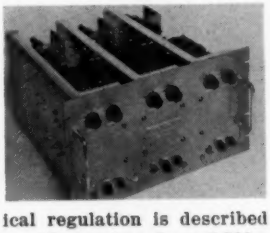
PRECISION CONSTANT CURRENT SOURCE Model CS-125 by **North Hills Electric Co., Inc.,** for life testing and aging of diodes provides up to 20 ma output with an accuracy of 1% ±.1 ua. Ten values of current settings may be specified for the front panel control switch. Thousands of zener diodes can be tested at once by connecting them in series to the rear ceramic terminal board. Typical regulation is described as .05% at 1ma from 0-500v. Priced at $10,950, F.O.B. Mineola, N. Y., the unit measures 19" x 10½" x 15" deep, rack mounted.



For More Information Circle EQ RSC #3

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VIBRATION METER, Model T-1A, by **Southwestern Industrial Electronics Co.,** is a portable, battery-powered and transistorized, with direct reading of velocity, displacement amplitude and acceleration. Can accept six transducer outputs, three velocity-type pickups, and three crystal accelerometers, reads up to 1,000 g, .01 to 100 in/sec velocity and .001-10 in. displacement at better than 5% accuracy. Plug-in high-pass filters can remove freqs below 10, 15, 30, 70, 110, 150 and 200 cps. Can be hooked into an oscilloscope or recorder to study vibration wave-forms.

For More Information Circle EQ RSC #4

TEMP-ALT TEST CHAMBER, Model FH-63-705-705, by **Conrad, Inc.,** allows testing of complete relay rack assemblies in its 7-ft high, 3-ft square interior. Alt to 200,000; temp range —100° to +300° F. Very rapid precision-controlled temp-alt change rates. Features include adjustable rate of climb and rate of dive valves, electronic temp recording controller with programming and automatic proportioning of heating and cooling.

For More Information Circle EQ RSC #5

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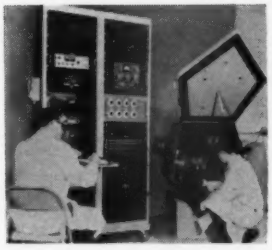
COUNTER-FLOW CONTROLLED HUMIDITY CABINETS in a new series by **Blue M Electric Co.** use a vapor pressure system to provide humidity of 40% to 98%, ±2% and eliminate the wet bulb control wick. Dry bulb, the range is 35° to 185° F., with the same close tolerance. High humidities are obtainable through the entire range with condensation on shelf specimens by the unique mechanical refrigeration system which runs constantly and through directional solenoid control of the coolant. Features include full glass inner door, enamelled steel floor stand, two adjustable, removable stainless shelves.

For More Information Circle EQ RSC #6

ACOUSTIC-NOISE TEST SYSTEM by **Associated Testing Laboratories, Inc.,** is designed to evaluate missile and aircraft components under simulated flight conditions. Said to produce sound pressure levels up to 150 db within eight controllable octaves covering frequencies from 37.5 to 9,600 cycles. The 15 cu ft chamber, **Model AN-RV-15,** will handle test specimens to 44 inches long; larger chambers are also being built. Mil specs energy requirements can be provided in a shaped random spectrum or in single frequencies up to 40,000 cycles.



For More Information Circle EQ RSC #7

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LOW TEMPERATURE CHILLING MACHINE, Model 7SR-120-32, by **Cincinnati Sub-Zero Products** is production line equipment for stabilizing metal aircraft structures. With pre-chilled convection fluid, 500 pounds of steel an hour can be brought down from ambient to —110°F. Thermal capacity of the chamber is 14,000 BTU/hr at —120°F.; minimum temp —150°F. Employs two mesh baskets 33" by 22". Overall dimensions: 140" long, 66" wide and 38" high; zinc-coated chamber itself measures 60 x 36 x 26.

For More Information Circle EQ RSC #8

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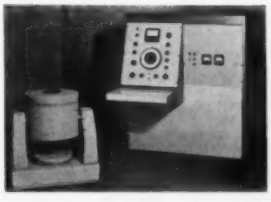
UNIFIED VIBRATION TESTING SYSTEMS in six models by **Unholtz-Dickie Corp.** produce 225 to 400 pounds force to 5,000 cps with good waveform. Precision automatic cycling controls regulate vibration while sweeping the 5 to 5,000 cps range. No impedance matching or oscillator switching needed in this range. Can be used with built-in accelerometer, an external one, or velocity pickup. Suitable for unattended endurance testing and meets government specs MIL-E-5272B. A series with generated forces to 2,000 lbs. is also offered.



For More Information Circle EQ RSC #9

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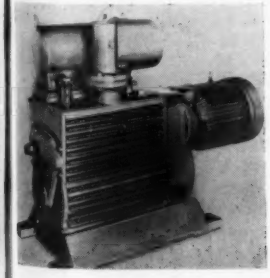
ROTARY MECHANICAL VACUUM PUMP in a new line of nine oil-sealed models by **Consolidated Vacuum Corp.** operates quietly at top speed by a unique air valve suppression port and through vibration-free balancing of the entire piston drive. Capacities range from 7 cfm to 106 cfm with net weights 132 lbs and 825 lbs respectively. Single-stage models create pressures down to 2 x 10^{-3} mm Hg; double-stage, 2 x 10^{-5}. Standard parts and assemblies for different models help keep cost to $750 to $1860 range and maintenance easy. Motor is standard 220-440 v, 3 ph, air cooled.



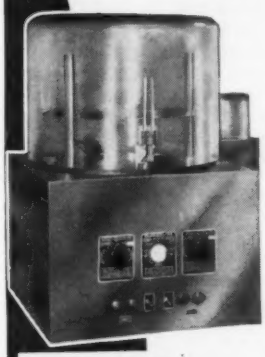
For More Information Circle EQ RSC #10

(For More New Products Turn to Page 34)

THE REVOLUTIONARY NEW LOW-COST

vapor-temp

CONTROLLED HUMIDITY CABINET



ONLY **$695.00**
Complete price
(No extras to buy)

CONTROLS HUMIDITY
20% to 99% within ± 2%
(Depends on Dry Bulb Temperature)

DRY BULB:
Ambient to 156° F. within ± 1° F.

MECHANICAL ANNULAR AIR FLOW
FULL ACCESSIBILITY
FULL VISIBILITY

Compact, Complete, fully automatic Controlled R.H. offered at low cost. Inverted Pyrex Jar (16"Dx12"H used as work chamber) placed on Stainless Steel Cabinet housing Controls, Motor and Blower. Guaranteed accurate and stable controlled humidity.

IDEAL FOR MANY MIL, JAN, AND ASTM TESTS

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1381h AND CHATHAM STREET
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OPERATIONAL TESTING under all ENVIRONMENTS

Use our facilities to evaluate product operation under all environmental conditions. Get automatic alternating cycles of contrasting conditions...remote control of product operation by mechanical, electrical or hydraulic means... and a wide range of supply voltages and frequencies. Simulate high-low temperatures, humidity, altitude, explosion, immersion, salt spray, sand and dust, rain, fungus, vibration, shock, acceleration, etc. Test to military, government and commercial specifications.

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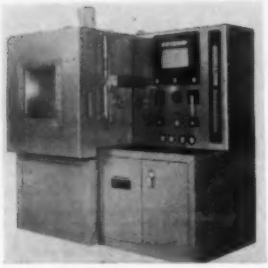


TEMPERATURE - ALTITUDE TEST CHAMBER, Model FH-27, by Conrad, Inc., has a 27 cu ft capacity, strip chart recording of temperature and features hydraulic action positive vacuum door locks. Ranges —100° to +300° or +500°F. Cools down to—70° F. in 38 minutes, back up to ambient in 14 minutes; amb'ent to 300°F. in 20 minutes and to 500°F. in 45 minutes. Potentiometer electronic recording controller for altitude and temp. Manometer control for altitude indication and vacuum throttle and bleed valves included.

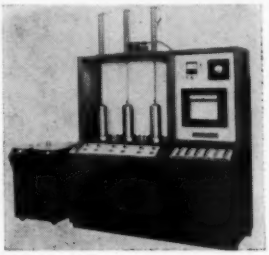
For More Information Circle EQ RSC #11

* * * *

PRODUCTION LINE VIBRATION TESTING MACHINE, Model 400-U-SP, by L.A.B. Corporation is a versatile, compact device for dislodging solder splatters, separating poor electrical connections and detecting fasteners improperly tightened. It can also be used as a settling shaker for packing lightweight material in bulk, and for simulating vibrations in rail and truck transportation. Standing slightly over 20" high, it has a plywood table 36" x 54" with a load capacity of 400 lbs. Operating at a fixed displacement of ⅛", the speed can be adjusted to increase or decrease the severity of shocks from 420 to 1200 rpm. At 760 rpm it produces slightly over 1 g.

For More Information Circle EQ RSC #12

LEAK DETECTION SYSTEMS in a new **Series 800** line by **General Vacuum Corp.** are designed for in line operation and high production rates on a fully or semi-automatic basis. They provide a dry, clean, fast test of vacuum, pressurized and hermetically sealed cylinders, refrigeration systems, missile parts and electronic assemblies. The series incorporates a spectrometer leak detector sensitive to helium with a probe to determine the exact location of a leak.



For More Information Circle EQ RSC #13

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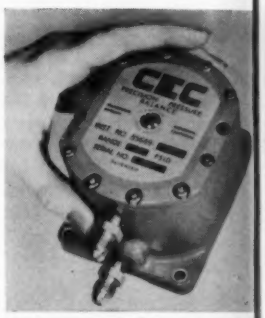
MINIATURE PRESSURE BALANCE by **Consolidated Electrodynamics Corp.** is one-fourth the weight (2.6 lbs) of older models and as big as a man's fist. Seven pressure ranges from 0-1½ to 0-150 psi are available in the device, **Type 4-332.** Full scale output of the transducer is ±100 volts with linearity and hysteresis effects limited to below .05%. The transducer can operate at 10% of its rated pressure without loss of accuracy and thus withstand surges of 10 times of this operating range. Designed for use with CEC's electromanometer precision pressure measuring system, 250 of the new balances will be used in the Air Force's supersonic wind tunnel at Tullahoma, Tenn.



For More Information Circle EQ RSC #14

You can DEPEND on -- Standard

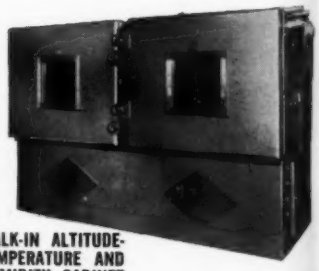
TEST CABINETS

FOR ACCURATE DEPENDABLE

ENVIRONMENTAL TESTS

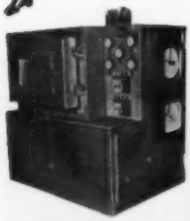
HIGH and LOW TEMPERATURES, ALTITUDE, HUMIDITY, FUNGUS, SAND and DUST, SALT SPRAY, RAIN and SUNSHINE, EXPLOSION and SPECIAL APPLICATIONS.

Every Standard test cabinet is designed for reliable and accurate testing, along with years of care-free durable operation. Whatever the simulated condition is desired to test your product accurately . . . correctly, there is a Standard cabinet to do the job. All guaranteed to give high level performance — the result of a decade of engineering skill and experience in designing and fabricating test equipment. Why not look into the many outstanding features offered by Standard today . . . send for our illustrated Catalog No. 59.



WALK-IN ALTITUDE-TEMPERATURE AND HUMIDITY CABINET

VIBRATION TEST-LIQUID CO₂-MECH. REFR. OPTIONAL



TEMPERATURE CABINET (OPTIONAL HUMIDITY)

self-contained units to meet every condition

WALK-IN EQUIPMENT FABRICATED TO ORDER

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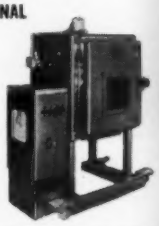

PANORAMIC SPECTRUM ANALYZER, Model SPA-2, by **Panoramic Radio Products, Inc.,** can study noise spectra, unstable oscillators and broad pulsed RF on an extremely narrow band of 1 mc or less. Two tuning heads are available: 50-250 mc and 220-4000 mc, both with 100 dbm sensitivity. The sweepwidth is adjustable 1 mc-0, resolution variable 10 kc-200 cps, and the sweep rate ranges 60-1 cps.

For More Information Circle EQ RSC #15

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PRESSURE GAUGE by **Hastings-Raydist, Inc.,** detects air or gas differences down to .0001" H_2O. Full scale reading on that model is .01"; others have full scale readings as high as 100". Electrically operated on 115v, the gauge senses through a thermopile installed in a flow tube. In application the flow tube can be installed direct in a line or across an orifice. Price: $250.

For More Information Circle EQ RSC #16

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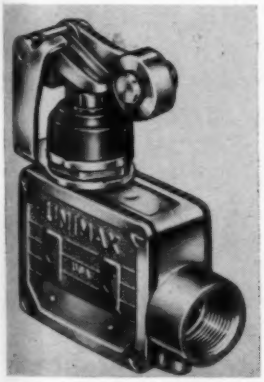

ENCLOSED PRECISION SWITCH by the **Unimax Switch division, W. L. Maxson Corp.,** has a two-way adjustable roller-lever for a wide variety of positioning. The arm adjusts through 240 degrees and the bracket can be rotated about the switch plunger and locked in eight positions 45° apart. Comes in 20 amps 125/250/480 volts a.c. but can also be supplied for ¾ hp 125v and 1½ hp 250v.

For More Information Circle EQ RSC #17

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TIME—CYCLE CONTROLLER, Model C1C500, by The Bristol Co. features extreme flexibility, controlling 10 different variables. It has 10 pilots, pneumatic, electric or combination, which operate simultaneously or in any sequence, each pilot capable of 24 operations. Intervals can be as brief as four seconds; timing discs range from 0-15 minutes to 0-360 minutes.

For More Information Circle EQ RSC #18

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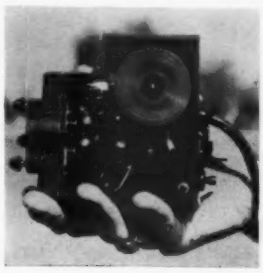
MINIATURE 16 MM CAMERA by **Traid Corporation** is equipped with variable shutter magazine heater, 28v DC motor and is adapted for interchangeable preloaded 50-ft. magazines. **Traid 15** weighs 2- 3 4 lbs., measures 5-5/16 x 2-15/16 x 4-7/16 in. and can be obtained with any single speed of 16, 64 or 100 frames per second. Has double tooth sockets for high g loading.



For More Information Circle EQ RSC #19

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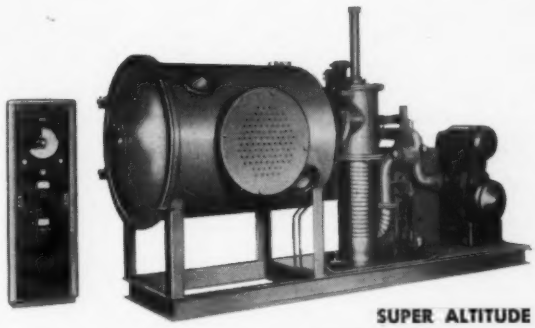
"RELIABILITY"...

MURPHY & MILLER

BUILDS IT!

Long before "reliability" became the magic word in describing every conceivable type of equipment, Murphy & Miller was building environmental test equipment that delivered reliability in terms that could be measured: CONTINUOUSLY ACCURATE PERFORMANCE UNDER THE MOST RIGOROUS OPERATING CONDITIONS. (We will always build reliability into everything that bears our name.)



SUPER ALTITUDE SIMULATION CHAMBER

- Sea Level to 350,000 ft. (760 MM Hg to ½ Micron)

COMBINED TEMPERATURE and VIBRATION SIMULATION TEST CHAMBER

- Sizes 1 to 64 cubic feet
- Temperature Range: —120°F. to +500°F
- ALL STAINLESS STEEL TEST SPACE
- Optional Recording, Controlling, and Programming Equipment Available
- Self Elevating Chamber Available (Optional)

COLD TEST CHAMBER

- Temperatures to —200°F
- Stainless Steel Test Space
- Forced Air Circulation
- Heating cycles available to 300°F
- Test space capacities start at 1 cu. ft.

For the *best* in environmental test equipment, check Murphy & Miller first. Write for illustrated circular.

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MEMBER OF ENVIRONMENTAL EQUIPMENT INSTITUTE

Firms Usher in 60s With News of Growth

A bumper crop of environmental expansions greeted the new decade. Growth news from all parts of the country came from such leaders of the industry as Aerotest Laboratories, Inc., Associated Testing Laboratories, Inc., Barry Controls, Inc., International Radiant Corp., The Rucker Company and Tenney Engineering, Inc.

In the East, two announcements affected southern environments. Associated Testing Laboratories told of plans for a major testing operation in Orlando, Fla., while Tenney Engineering prepared to expand its heat transfer components division into a brand new facility in Wilmington, N. C.

On the West coast, Barry Controls took over a bigger facility to house its growing operation there. Rucker similarly enlarged its western capacity.

New Home for Aerotest

While some were building, Aerotest, a leading Long Island test and research lab, found a ready-made site for its expansion at Deer Park, N. Y., about 40 miles from New York City. With the new year, Aerotest began moving out of College Point to Deer Park.

Simultaneously, H. J. Shapiro and Lee Permut, principal officers of the firm, announced formation of a third Aerotest operating unit, the Advanced Propulsion division. The other two are Test Engineering and Product Engineering.

Aerotest's new home is the former Fairchild Engine & Airplane Corp. gas turbine laboratory. It is a multi-million dollar installation, built in 1955 on a 14-acre site adjacent to Deer Park airport.

The announcement described the new division as "the only facility of its type and size in operation by any independent test laboratory in the country. It has been designed, equipped and staffed," the Aerotest officers continued, "for complete research, test and evaluation programs on a wide variety of gas turbine, rocket, ram-jet and diesel engines and associated equipment."

Double Growth at ATL

In addition to the planned Orlando operation, Associated Testing Laboratories told of a new home plant rising in Wayne, N. J., that will double the size of the old facility in Caldwell, N. J. ATL is a chamber manufacturer as well as a commercial tester.

William Tonkowich, president of the firm, said occupancy of the 30,000-foot Wayne plant, to cost around $500,000, is expected early this year. A five-acre site will permit future plant expansion by another 40,000 square feet.

Bernard Novack, ATL vice president, said the Orlando lab was prompted in part by a recent contract award from Martin-Orlando for reliability and environmental tests on missile components and parts. He did not give the amount of the contract but added:

"The increasing need for a highly dependable, fully flexible testing service for the growing industrial complex in Florida has prompted us to include this new division in our expansion plans. We hope to be in full operation at Orlando next Spring."

Seven Production Lines

Tenney, Union, N. J.-based producer of environmental chambers, has a coil division in Baltimore. The new Wilmington plant is adding seven production lines to that division's capacity. Tenney makes heat transfer components for the commercial, original equipment market as well as for its own chambers.

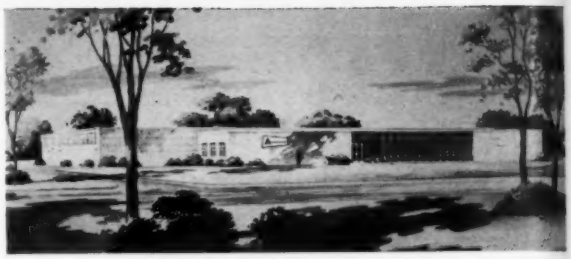
Sid Shapiro, head of the division, said Wilmington was due to start shipping on schedule at the first of the year. The new plant has 75,000 square feet of space and will ultimately employ 250 to 300 persons, he said.

Expansion in the West

In Glendale, Calif., Barry Controls acquired an expanded facility at 1400 N. Flower St., to house complete sales, engineering and manufacturing facilities for its shock and vibration controls and testing machines.

Ervin Pietz, president, said the move was part of a planned growth program

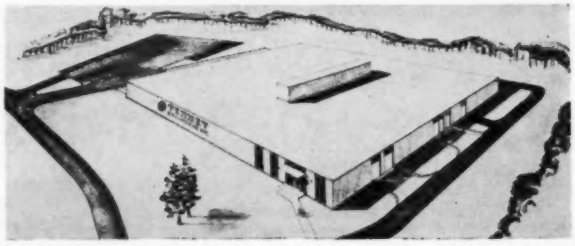
(*Continued on Page 38*)



A NEW BUILDING (right) is rising in Wayne, N. J. for Associated Testing Laboratories, Inc., which has both testing and manufacturing divisions. Cost is estimated at $500,000.

THE EAST AND THE WEST provide examples of new environmental real estate. At left is the plant of International Radiant Corp., a chamber manufacturer, in New York, and above is the new western headquarters building of Barry Controls, maker of shock and vibration controls and shock testing machines, in Glendale, Calif.

PART OF THE NEW HOME Aerotest Laboratories, Inc., is occupying in Deer Park, N. Y. is shown in the aerial view at right. Aerotest has also organized an Advanced Propulsion division.



THIS STRUCTURE (left) houses the expanded heat transfer components division of Tenney Engineering, Inc., in Wilmington, N.C. It has already begun making shipments.

CONRAD Inc.

TEMP-RAC 19

HIGH-LOW TEMPERATURE TESTING WHEN & WHERE YOU WANT IT!

Testing small assemblies and components to military and government specifications is simple and convenient with Conrad's new Temp-Rac 19. Move it anywhere in your laboratory, any place on your production line. Temp-Rac 19 has a range of —90° to +300°F., 16" x 16" x 16" I.D. test area, and it's air cooled, requiring only electricity for operation. One or more of these compact chambers can give your facilities the flexibility that assures more efficient testing and production. Ask your Conrad representative to show you. Write today.

- —90° to +300°F., clear of coil and circulator.
- Occupies only 4 sq. ft. floor space — easy to move on heavy duty swivel casters supplied with chamber.
- Light recessed into chamber ceiling.
- Safety mesh for fan.
- Patented Conrad Cascade Refrigeration System.
- 220 volt, single phase, 60 cycle, 3-wire service.
- Optional features include view window in door, access ports, removable door with shelf assembly, terminal pads.

CONRAD Inc.

HOLLAND MICHIGAN

Introduced only a few months ago, the Conrad Temp-Rac 19 has won quick acceptance because of its wide application in production and testing. Conrad suggests placing orders early to assure delivery from stock.

Subsidiary, Crampton Mfg. Co. Grand Rapids, Michigan

HARRIS HELPS... HOOVER

ASSURE DIMENSIONAL STABILITY OF TOOLS AND GAGES

Ernest U. Day, Foreman of Hoover's Tool Department, applauds the performance of their Harris 6 cu. ft. heavy-duty chilling machine for achieving "more accuracy and more stability", the two prime objectives of tool and gage fabrication.

A Harris Chilling Machine during the past two years has solved the serious problem of achieving dimensional stability in steels for gages in the Tool Department of the famous Hoover Company, North Canton, Ohio, leading manufacturer of vacuum cleaners. Chilling has also proved a quicker and more positive method for shrink-fits on die assemblies.

Super-chilling at –130° to –150° F and tempering will achieve 100% transformation of austenite to martensite in water and oil-hardening steels, ideally suited for gages but slightly sluggish to austenitic decomposition.

A super-chill also increases Rockwell hardness by several points in high-carbon, high-chrome steels, needed for dies but also sluggish in transformation.

LEARN HOW CHILLING CAN IMPROVE YOUR TOOLS AND PRODUCTS . . . AT LESS COST. WRITE TODAY OR SUBMIT SAMPLE PARTS FOR TEST PROCESSING. NO OBLIGATION.

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Specialists in refrigeration engineering, manufacturing, and service since 1934.
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Environmental Business

Ling-Altec Sales Soar; Others Hit Fiscal Peaks

Ling-Altec Electronics, Inc., Anaheim, Calif., expects its fiscal 1960 sales figure to skyrocket to $45 million compared to just under $7 million in the previous fiscal year, which ended last July. The manufacturer of vibration test equipment and communications systems recently reported an order backlog of $55 million.

Air Reduction Company, Inc., New York, reported a record nine-month sales of $151 million, up 17 per cent from 1958, and net income of well over $11 million, also a 17 per cent jump.

Varian Associates, Palo Alto, Calif., increased earnings 67 per cent and sales 32 per cent for the 12 months ended last September. Sales ran over $38 million with net income of $2.5 million.

Barry Controls, Inc., Watertown, Mass., reported nine months' earnings 58 per cent above 1958 and predicted a record 1959 year. Net sales were $4 million, with earnings of over $300,000. The vibration and shock controls firm declared a quarterly bonus for employes of $11,000, making the nine-month bonus total nearly $40,000.

* * *

As part of a program of major corporate expansion, Telecomputing Corporation bought Monrovia Aviation Corporation for around $2-million from Carrier Corporation. Monrovia makes aircraft sub-assemblies and ground support equipment.

Firms Usher in '60s

(Continued from Page 36)

that began last summer with a 20 per cent increase in floor space of the firm's home plant in Watertown, Mass. Barry acquired West Point Manufacturing Company, of Detroit, last September. Mr. Pietz said Barry's nine-month '59 earnings ran 58 per cent ahead of the like 1958 period.

Rucker, an Oakland, Calif., firm chalked off an expansion milestone by moving its Seattle office into a twice-as-big location. The new address, 1705 Fourth Ave., S., doubles warehouse space for Rucker's stock of hydraulic and pneumatic systems. Last August a similar expansion of the Portland branch took place.

IRC Takes Larger Quarters

International Radiant Corp., busy expanding its line of environmental chambers, moved to larger quarters in uptown New York at 577 E. 156th St. It formerly was located in Westbury, on Long Island.

Bernard Friedman, IRC's general manager and technical director, said the added space will permit offering "off-the-shelf deliverics" of chambers and faster design and production of the low-cost ValuLine series.

IRC is supplying test chambers to the new Army ordnance research lab at Picatinny arsenal.

HARRIS CHILLING HELPS MAKE PRECISION THEIR MIDDLE NAME AT . . . .

MPB

Miniature Precision Bearings, Inc., Keene, N. H., achieves dimensional stability in their tiny bearings through chill-treating AISI-440-C S.S. and SAE 52100 steel in their Harris Chilling Machine. The chilling process, at –120°F., minimizes molecular rearrangement and also effects further transformation from austenite to martensite.

MPB also stabilizes tools and gages through Harris chill-treatment of alloy tool steels and high speed steels used in their fabrication.

Harris Model 5L-B2 Refrigeration Machine chill-treats steel at MPB for dimensional stability in precision bearings, tools and gages.

Requiring the utmost in dimensional stability, MPB bearings are designed to operate at temperatures from –65° to +150°F. In smaller sizes, 1000 MPB bearings weigh only 3.3 oz. Largest MPB part is the outer ring of a ⅜ inch ball bearing. The company has been so successful in living up to its middle name, "Precision," that it was chosen one of the top ten plants in the U.S. by the magazine, "Factory Management," in 1957.

The Company's General Marketing Manager, Mr. R. I. Kern, testifies that their Harris Chilling Machine effectively speeds transformation of the steels, gives more than adequate temperature control within 5°F., and offers easy accessibility for operation and adjustment.

ASK HOW CHILLING CAN CUT YOUR COSTS, AND IMPROVE YOUR PRODUCT . . . NO OBLIGATION FOR OUR ADVICE.

HARRIS REFRIGERATION CO.

312 RIVER ST., CAMBRIDGE 39, MASS.
Our 26th Year as Specialists in Refrigeration Engineering, Manufacturing, Service
MEMBER OF EEI

Surosky, Hill Plan Expansion Of General Testing Laboratories

Dr. Alan E. Surosky has been elected president and Dudley A. Hill, executive vice president, of General Testing Laboratories, Inc. E. S. Brown, formerly president, continues his association as vice president of the Carlstadt, N. J., specialists in environmental testing to government and industrial specifications.

Both new members of the GTL management team came from Melpar, Inc., where Surosky was staff engineer and Hill was quality control manager. Both also held top technical posts at United States Testing Company, Inc., at one time.

A GTL announcement said they plan an expansion to include supporting engineering and research, product development, reliability analysis and new sophisticated test procedures.

Foreign Alliances

Varian Associates has formed a Swiss subsidiary, Varian A. G., to handle expanding markets abroad for its high vacuum devices, microwave tubes and scientific instruments. Dr. Warren Proctor heads the new subsidiary, with offices at Zug.

Jet Age Environment

Scandinavian Airlines System recently installed an environmental test facility to simulate flight conditions so that it might determine the most efficient consumption controls for jet fuel.

Among the Reps

The Will Corporation, Rochester, N. Y., received an oak plaque commemorating its 40th anniversary of service to scientific, research and control laboratories. The plaque was presented by Labline, Inc., a leading maker of laboratory equipment and apparatus.

Acton Laboratories, Inc., Acton, Mass., has appointed as sales reps for its line of electronic lab test instruments: Saffro & Associates, Chicago, for Wisconsin and western Illinois; Lawrence L. Hill, Wichita, for Kansas, Missouri and southern Illinois; and White & Company, Palo Alto, for nothern California and Nevada.

The United States Testing Company, Inc., has appointed Nat Kronstadt Associates, Silver Spring, Md., as its engineering representative in the Washington area.

Vibration Consultant

Donald L. Wrisley, former sales manager and assistant to the president of the Calidyne Company, Inc., vibration equipment manufacturer, has formed his own consulting company in the environmental vibration field, Wrisley Engineering, Inc., Winchester, Mass. *(Circle EQ RSC "A")*

GE Opening New Space Lab

General Electric Company expects to start moving in sometime this year to its new $14 million space technology center on a 130-acre site just west of Philadelphia.

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Associated Testing Laboratories, Inc.	3
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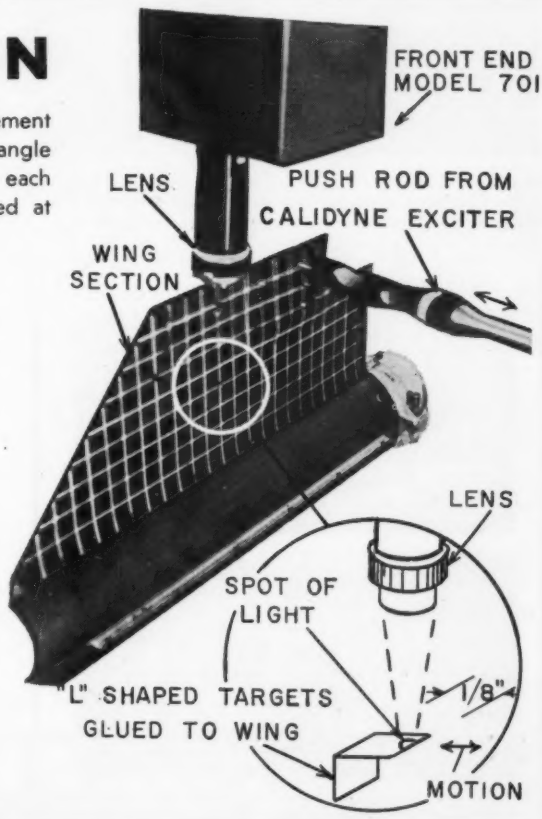
WING VIBRATION

New daylight 701 measures amplitude of displacement of selected points on a missile wing. Small right angle targets of .020" aluminum foil ⅛" x ⅛" are glued at each intersection of grid lines. Hard industrial wax gunked at back of target to deaden flutter of target itself.

Spot of light is focused on top edge of target. Wing is driven with horizontal push rod from Calidyne exciter. Vibration measured is perpendicular to wing surface. Instrument may be scanned from point to point without stopping exciter.

Measurements accurate to .001" may be made at a working distance of 56" from lens. Five other interchangeable lenses cover displacement ranges of .050", .100", .500", 1.0", & 2.0" full scale. Best resolution 12 micro inches. Frequency response static to 7 Kc. Output 16 volts full scale, 250 ohms.



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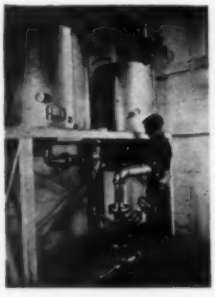
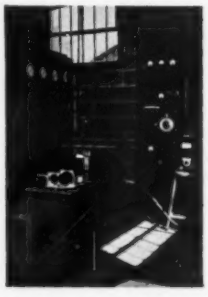


Hydrogen Peroxide flow testing—flow rates to 150 gpm, static pressures to 3,000 psi.



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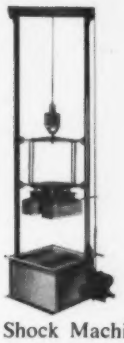
150VD Shock Machine



20VI Shock Machine

SHOCK TESTING

(SECOND OF A SERIES)

Although the JAN-S-44 Shock Machine satisfied the early requirements for shock testing of small components, there was an increasing demand for a machine that would test specimens far heavier than the JAN-S-44 capacity of four pounds.

To accommodate specimens up to 150 pounds and to simulate aircraft landing shock more closely, Barry Controls designed the 150 Variable Duration shock machine in 1948. This device was evolved under contract from WADC and followed a basic design approach suggested by them. The machine was later called out in MIL-E-5272 and MIL-S-4456.

The 150 Variable Duration shock machine accommodated equipment up to a 30-inch cube, weighing up to 150 pounds. The elevator table was dropped into a box filled with a special kiln-dried sand from the Ottawa River. This particular sand was specified for its anhydrous characteristics, since variations in moisture could produce variations in the pulses.

A set of impact blocks, attached to the lower side of the elevator, was used in varied arrangements to provide variations in shock-pulse time duration ranging from 6.5 milliseconds to 32 milliseconds for various peak acceleration levels.

The 150VD sand-drop technique became standard in laboratories across the country, and hundreds of machines were installed. Modified to take larger loads, the original 150VD became the 150-400VD, accepting loads as high as 400 pounds and as large as a 30-inch cube. Not only did these machines help to establish the standard four-inch, 15g, 11-millisecond pulse and the thirteen-inch, 30g, 11-millisecond pulse, but they were capable of producing peak shocks of 75 g's at the five-foot maximum drop height.

Several machines were evolved to meet varying requirements, all using the standard sand-drop technique. The Barry 1200 Shock Machine was developed to take loads of 3,000 pounds and to encompass a missile twenty feet high. The top of the machine was open so that the missile could be raised to a drop freedom of five feet, and a unique release mechanism was incorporated. The Barry 20VI Shock Machine, taking loads up to 50 pounds, produced calibrated shock tests up to a 210g peak acceleration. The 20VI also incorporated a procedure, using lead pellets, to produce approximate square-wave pulses. Popular in laboratories, the 20VI is widely used in environmental test facilities.

By the mid-1950's, the importance of shock testing was becoming apparent, and instrumentation was rapidly developing for more accurate measurement. At the same time, a demand developed for generation of close-tolerance shock pulses.

Variations in shock-machine instrumentation, preparation of sand, and resonant response made it evident that the repeatable pulse necessary for accurate laboratory evaluation could not be consistently obtained from sand-drop tests.

To meet the new requirements of shock testing, still more advanced machines were being designed.

(To be continued)

Write for "How to Evaluate Shock Tests" by Charles E. Crede

Leaders in Shock Simulation

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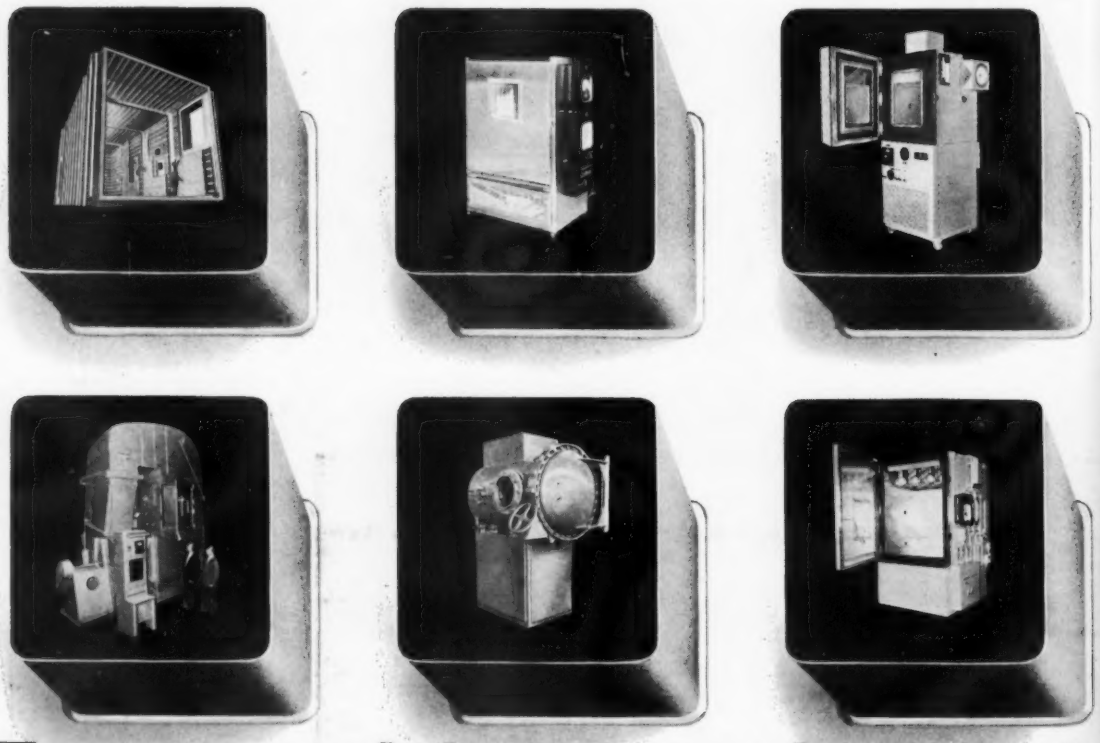
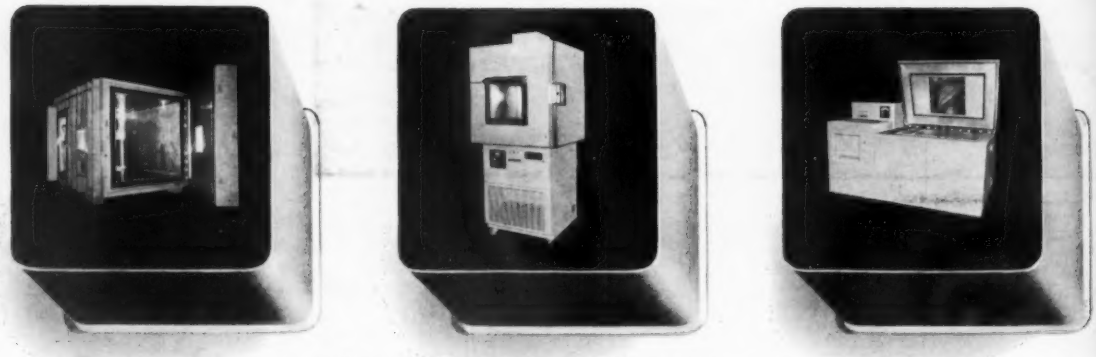


Tenney push-button environments



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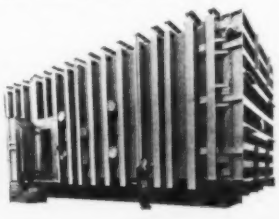
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